

ENVIRONMENTAL HEALTH & SAFETY (EH&S) PROGRAMS AND SERVICES

UNIVERSITY UNITS SUPPORTED

TECHNICAL SERVICES PROVIDED

BUSINESS DRIVERS

Version: December 6, 2012





Table of Contents

OCCUPATIONAL HEALTH & SAFETY **4**

Research Laboratories and Clinics	5
General Workplace Settings	5
Facilities Service Operations	6
Construction / Renovation	6
Newly Emerging and Developing Areas of Research	8
Research Affiliated Security Management	8
Safety Risk-Reduction Initiatives	9
Expanding Health and Safety Coverage to New and Existing Facilities	9
On-Site Occupational Health Services	10
Operational Space Needs	10
General Injury & Illness Prevention	12
Ergonomics	26
Facilities Construction, Renovation, Maintenance, and Decommissioning	29
Hazardous Materials Compliance and Management Program	36
Industrial Hygiene	39
Laboratory Safety	48
Safety and Compliance Assistance Program	58
Occupational Safety	61
University Occupational Medicine Health Center	68

HEALTH PHYSICS **80**

Licensing, Registration, and Authorizations	82
Administrative Panel / Committee Support	83
Database and Inventory Management	84
Exposure Monitoring	85
Contamination Surveys / Tests and Response	86
Facility Plan Reviews and Decommissioning	87
Radioisotope Production	88
Human Subjects and Clinical Patients	88
Radioactive Materials Delivery	89
Training	90
Laser Safety and Non-Ionizing Radiation	90

FIRE SAFETY **92**

Code Compliance	93
Plan Reviews	94
Inspections	95
Liaison with local jurisdictions	96
Maintenance and Testing Fire Protection Systems and Fire Alarms	97
Remote Fire and Intrusion Alarm Monitoring Station	98
Training	99
Fire Investigations	100
Special Event Planning	101
Facility Design and Construction Standards	101
Code Development	102



ENVIRONMENTAL PROTECTION	103
Hazardous Waste	104
Air Emissions	112
Wastewater Discharge Management and Compliance	113
Hazardous Material Spill Prevention and Response	114
Plan Reviews	114
Sustainability	115
Toxic Substances Control Act	115
Historical Activities (Projects)	116
TRAINING AND COMMUNICATIONS	118
Compliance Training	119
Course Delivery	120
Communications / Publications / Distribution of Materials	121
Future Needs / Challenges	122
EMERGENCY MANAGEMENT	123
Planning and Assessment	125
Emergency Operations Center (EOC)	125
Response Teams	126
Biennial emergency exercises	127
Preparedness Education	127
Mass Notification Programs (AlertSU)	128
Non-Structural Hazard Mitigation Program (ProtectSU)	128
Business Continuity Program (PrepareSU)	129
Campus Medical Response Plan	129
Risk Assessment	129
CHEMTRACKER	131
Reference Database	132
Regulatory Reporting	132
Chemical Safety Information	133
ChemTracker Consortium	133
INFORMATION TECHNOLOGY (EH&S IT)	134
Project Services	135
Operational Services	137
APPENDICES	138

CREDITS

EH&S Programs and Services publication was developed by Environmental Health and Safety (EH&S) at Stanford University. Please direct all questions and comments to EH&S (650) 723-0448 <http://ehs.stanford.edu>.



Executive Summary

Overview

Environmental Health and Safety (EH&S) is the principal health and safety office at Stanford University. EH&S works closely with the University Safety Partners (the designated safety officers in the laboratory schools and senior administrative units including Land Buildings and Real Estate and Residential and Dining Enterprises) and the safety coordinators, safety committees, administrators and faculty in the departments. The EH&S mission is to support and advance the teaching, learning and research activities of the University through promotion of a safe and healthy campus environment by providing and coordinating programs and services that minimize safety, health, and environmental and regulatory risks to the Stanford University community in a manner consistent with responsible fiscal and environmental stewardship.

Summary

Occupational Health & Safety Programs support research laboratories and clinics, general workplace settings, facilities service operations, and construction / renovation. Business drivers for these programs include assurance of a safe and healthful work environment and institutional regulatory compliance. **Health Physics** Programs support research laboratories, the Stanford Hospital and Lucille Packard Children's Hospital, the Veterans Affairs Palo Alto Health Care System, radiochemistry facilities, research committees, and construction / renovation. Business drivers for these programs include radioactive materials research (including clinical drugs), radioisotope production, spills and releases, institutional regulatory compliance, new construction and remodeling, facility usage, and laser use. **Fire Safety** programs support the Stanford Main Campus, School of Medicine, Hopkins Marine Station, SLAC National Accelerator Laboratory, and new construction and remodeling projects. Business drivers for these programs include fire prevention engineering, building and fire codes, hazardous materials use, annual fire safety inspections, cost of risk, multiple jurisdictions, fire-fighting service contracts, equipment failures and after-hours response, and building occupancy. **Environmental Protection** programs support research laboratories and clinics, facilities service operations, and construction / renovation. Business drivers for these programs include the federal and state Environmental Protection Agencies (EPA), Bay Area Quality Management District, County of Santa Clara Department of Public Health, and the Regional Water Quality Control Board. **Training and Communication** programs support general workplace settings, research laboratories and clinics, facilities service operations, and construction / renovation. **Emergency Management** programs support Public Safety, Emergency Management Steering Committee, Departments and Schools, General Workplace Settings, and Research Laboratories and Clinics. **ChemTracker** supports the research laboratories and clinics, general workplace settings, facilities service operations, and construction / renovation. Business drivers for the program includes the Laboratory Standard, Hazard Communication Standard, and regulatory compliance. **Information Technology** (EH&S IT) supports the EH&S units of Administration, Biosafety, Hazardous Materials, Health Physics, and Training. Business drivers for the unit include ChemTracker, Hazardous Waste, and STARS.

Programs and Layout of Document

This document provides an overview of eight major divisions that comprise EH&S:

1. Occupational Health & Safety (includes Biosafety and Occupational Medicine Clinic)
2. Health Physics
3. Fire Safety
4. Environmental Protection
5. Training and Communications
6. Emergency Management
7. ChemTracker
8. Information Technology (EH&S IT)

Within each division, there is an identification of the university units supported, technical services provided, business drivers, and major program elements.



Biosafety
Ergonomics
Facilities
Hazardous Materials
Industrial Hygiene
Laboratory Safety
& Chemical Hygiene
Safety & Compliance
Workplace Safety

Occupational Health & Safety

The Occupational Health & Safety (OHS) Group supports the education and research mission of the University by providing critical development and on-going management of institutional programs designed to protect health and safety covering a broad spectrum of occupational, research, learning and living environments.

Supports these University Units:	Technical Services Provided	Business Drivers
<ul style="list-style-type: none"> • Research Laboratories and Clinics • General Workplace Settings • Facilities Service Operations • Construction / Renovation 	<ul style="list-style-type: none"> • Biosafety • Ergonomics • Industrial Hygiene • Laboratory Safety and Chemical Hygiene • Occupational Medicine • Facility Construction, Renovation, Maintenance, and Decommissioning • Hazardous Materials Management • Safety and Compliance • Workplace Safety 	<ul style="list-style-type: none"> • Assurance of a safe and healthful work environment • Institutional regulatory compliance • Financial loss control including workers' compensation, regulatory penalty, legal liabilities and potential funding losses.



University Units Supported

The OHS staff is responsible to support faculty, staff and students in laboratory/clinical areas, general workplace settings (e.g., office areas, libraries) and facilities service operations (e.g., building/ grounds maintenance, utilities).

Research Laboratories and Clinics

Research personnel are provided comprehensive health and safety support relating to chemical safety, biosafety, compliance assistance, ergonomics, hazardous materials management, and laboratory safety. Examples of common services include:

- Laboratory safety training
- Safety consult on research procedures/ practices
- Biosafety review and approval of new research protocols
- Medical surveillance for special exposure hazards
- Radiation safety surveys
- Ergonomic consult on high risk lab processes such as microscopy and manual pipetting.
- Regulatory screening/ reporting for acquisition/ possession of regulated materials (i.e., hazardous chemicals, controlled substances, select agents)

OHS staff industrial hygienists and biosafety professionals provide technical management and oversight of chemical, biological, and physical hazards in laboratories and clinics. Hazards addressed range from carcinogens, highly-reactive materials, toxic gases, bloodborne pathogens and other infectious materials, as well as physical hazards such as ergonomic stressors, machinery operation, etc. OHS personnel also support the institutional review committees on The Biosafety Manager is also a key participant in critical compliance-driven safety committees and panels (e.g., Human Subjects Panel, Biosafety Committee, APLAC Committee).

OHS services include a full-service Occupational Health Center that provides medical surveillance/ screenings for special exposure hazards and specialty medical care for research-related exposures/ injuries.

The Safety and Compliance Assistance Program conducts routine visits of laboratories and shops to ensure they are compliant with numerous regulations covering a wide

range of topics (e.g., hazardous waste, hazardous materials storage, radiation sweeps). Complex technical issues are referred back to the appropriate EH&S specialist (e.g., Biosafety Manager, Industrial Hygienist, Health Physicist, Fire Marshal).

The Hazardous Materials Management (HMM) Program supports the efforts of all University chemical users (i.e., researchers, basic facilities operations) to ensure their hazardous materials are properly inventoried, reported to regulatory agencies, and to provide chemical reference information to assist the University in complying with hazard communication/ right-to-know requirements. The HMM Program's chemical inventory database is heavily relied upon by a diverse range of University groups for regulatory compliance as well as for basic business function.

New laboratory facilities are supported via a plans review process that addresses the research design requirements of the Principle Investigator, while ensuring that a healthy, safe and compliant facility is provided for laboratories. Laboratories coming off-line are assisted through laboratory decommissioning efforts to ensure regulatory compliance.

● ● ●

Hazards addressed
range from carcinogens,
highly-reactive
materials, toxic gases,
bloodborne pathogens
and other infectious
materials

● ● ●

General Workplace Settings

Personnel working in offices, libraries, and other non-laboratory environments are provided support primarily related to ergonomics, indoor air quality, odor complaints, and general safety issues. The OHS staff also assists and collaborates with other departments, such as Human Resources and Risk Management, in the development of University guidelines and policies which have health and safety impacts, such as telecommuting, children & pets in laboratories, golf cart usage, and non-smoking policies. Examples of common services include:

- Computer workstation ergonomics consultation and training
- Investigation of odor complaints and office air quality concerns



- Evaluating miscellaneous office health and safety concerns related to renovation and construction projects.
- Workplace injury/ illness care and preventive care (i.e., immunizations)

Facilities Service Operations

University service groups such as Buildings/ Grounds Maintenance, Utilities, Student Housing, and Residential and Dining Enterprises are provided technical support with topics including but not limited to ergonomics, asbestos/ lead- related activities, industrial safety, and hazardous materials management. Examples of common services include:

- Cal/OSHA mandated safety training
- Ergonomic consult on high risk processes including manual handling procedures and repetitive tool use.
- Provide evaluation and oversight of maintenance and renovation projects that involve the disturbance of asbestos and lead containing materials.
- Assisting departments manage safe work in confined spaces
- Exposure assessment of workplace stressors such as noise and airborne contaminants.
- Workplace injury/ illness care and preventive care (i.e., immunizations)

Construction / Renovation

In critical support of new construction and remodeling projects, the OHS Program oversees various health and safety efforts to ensure occupant safety and regulatory compliance. Examples of common services include:

- Management of hazardous construction material (e.g., asbestos and lead)
- Development and maintenance of facilities design and construction standards
- Product reviews to minimize impacts from products installed during construction
- Facility decommissioning/ closure
- Construction site safety



SUMMARY

Occupational Health & Safety provides services to research personnel; employees working in offices, libraries, and other non-laboratory environments; University service groups (such as Buildings / Grounds Maintenance, Utilities, Student Housing, and Residential and Dining Enterprises; and critical support of new construction and remodeling projects.



Technical Services Provided

The OHS Group manages numerous programs that provide critical EH&S services to the University. The OHS Program provides a broad range of workplace health and safety services which are summarized in the following table:

Biosafety	Ergonomics	Industrial Hygiene	Laboratory Safety & Chemical Hygiene
<ul style="list-style-type: none"> • Research Protocol Review • Research Compliance Panels • Biosecurity • Laboratory Animal Occupational Health Program • Bioemergency Response • Biosafety Cabinets & Biowaste Compliance • Specialized Training 	<ul style="list-style-type: none"> • Computer Ergonomics • Laboratory Ergonomics • Material Handling • Promotion- Ergonomic Risk Reduction <i>(Campus-wide, and targeted risk groups)</i> 	<ul style="list-style-type: none"> • Accident/Incident Investigation • Hazard Communication • Chemical Exposure Assessment • Respiratory Protection • Noise-- Hearing Conservation • Indoor Air Quality • Confined Space Entry • Reproductive Health Hazard Evaluation 	<ul style="list-style-type: none"> • Chemical Hygiene Plan Management • Specialized Laboratory Training • SOP/Experimental Protocol Consultation • Toxic Gas Usage • Laboratory Design & Plans Review • DEA Controlled Substances & Precursors • Select Agent Toxins
Facilities	Hazardous Materials	Safety and Compliance	Workplace Safety
<ul style="list-style-type: none"> • Hazardous Construction Material Management • Project Safety • Facility Decommissioning and Closure • Sustainability • Playground Safety 	<ul style="list-style-type: none"> • Regulatory Reporting • Chemical Inventory Information Management • Chemical Facility Anti-Terrorism • Chemical Safety Information Services • Life Safety Box Program 	<ul style="list-style-type: none"> • Safety & Compliance Surveys • Regulatory Agency Inspections • Training • Radiation Surveys • Support with Laboratory Moves • Specialized Support Services for Department of Chemistry • Calibration of Radiation Survey Meters 	<ul style="list-style-type: none"> • Loss Control & Risk Reduction • Slips, Trips, Falls • Lockout/Tagout & Electrical • Fall Protection • Lift Trucks, Hoists, & Cranes • Industrial/Shop Safety

OHS Programs are supported by qualified technical staff, of which most are cross-trained in multiple program areas. The technical and educational background of the group is extremely strong, consisting of: Two MDs (Occupational medicine), two Ph.D.s (Genetics, Microbiology/ Virology), seven masters degrees (Public Health, Kinesiology, Nursing, Physician Assistance Studies). Professional certifications include four Certified Industrial Hygienists, one Board Certified Occupational Health Physician, two Certified Occupational Health Nurses, two Certified Medical Assistants, and one Certified Fire Prevention Officer.

Business Drivers

Establishment and effective operation of OHS programs at Stanford is business essential. The primary institutional business drivers for OHS services include:

Institutional regulatory compliance

Compliance with regulatory agencies including but not limited to the following: Cal/OSHA, NIH, CDC, FDA, DOD, USDA, USDA, HHS, Homeland Security, WHO, SC County Environmental Health, DOT, IATA, Fed DEA, CA DOJ, BAAQMD.

Assurance of a safe and healthful work environment

This includes *maximizing workforce productivity, and minimizing workplace safety / health risks* to personnel. *Protection of the University's public reputation* is also a major concern for the University. Serious campus accidents or poor management of related risks can prompt a cascade of negative public scrutiny that can result in irreparable damage to institutional reputation.



University's Emerging Occupational Health & Safety Needs

In anticipation of current and emerging University needs, the program plans to focus future efforts in the following areas:

1. Newly Emerging and Developing Areas of Research
2. Research Affiliated Security Management
3. Safety Risk-Reduction Initiatives
4. New and Existing Facilities
5. On-Site Occupational Health Services
6. Operational Space Needs

Newly Emerging and Developing Areas of Research

Four major areas of evolving research technologies that are anticipated to drive significantly increasing health and safety support needs in the near future are as follows:

Nanomaterials

Nanomaterials are used in variety of research applications such medical applications involving microscopy imaging; electronic devices; energy storage devices; fuel production; and fundamental physics and materials science research.

Systems Biology

The molecular aspects of cellular and organismal regulation, the quantitative analysis of cellular regulatory systems, and the development and application of comprehensive chemical and genetic tools for perturbing and probing regulatory networks.

Translational Research

Translational research, or "bench-to-bedside" research wherein a basic laboratory discovery becomes applicable to the diagnosis, treatment or prevention of a specific disease. Translational medicine may also refer to the wider-spectrum of patient-oriented research that embraces innovations in technology and biomedical devices, as well as study of new therapies in clinical trials.

Synthetic Biology

Synthetic biology can be broken up into two parts - "bottom up", the design and construction of new biological parts, devices, and systems and "top down", the re-design of existing, natural biological systems for useful purposes.

PROGRAM NEEDS

Newly Emerging and Developing Areas of Research

Anticipated areas of future OHS program focus relating to emerging research technologies are as follows:

- **Increased outreach, training, and guidance** for the Stanford research community regarding potential hazards and safe laboratory practices.
- **Increased research support** with provision of protocol reviews and consults as deemed necessary by the University's Administrative Panel on Biosafety and other institutional review committees.

Research Affiliated Security Management

In managing institutional risks relating to current and emerging research technologies, Stanford has been increasing its focus on security-related institutional support in the following areas:

Chemical Facility Anti-Terrorism Standards (CFATS)

In 2007, the Department of Homeland Security (DHS) published the [Chemical Facility Anti-Terrorism Standards \(CFATS\) Interim Final Rule](#). This regulation requires all chemical facilities including colleges and universities to file a "Top Screen Report" identifying possessed volumes of specifically listed 'chemicals-of-interest'. The purpose for this report is to determine the risk level and necessity for implementing security plans for those facilities.



Biosecurity – Dual Use Research

Dual Use research describes biological research yielding information and technologies with the potential to be misused to pose a biologic threat to public health or national security. The National Science Advisory Board for Biosecurity (NSABB) was established in 2004 to address issues of Dual Use and provide advice and guidance. In September 2011 the NSABB released a report stating recommendations for institutions working with biological agents, including Select Agents.

PROGRAM NEEDS

Research Affiliated Security Management

Chemical Facility Anti-Terrorism Standards

*Given the CFATS compliance mandate, **on-going vigilance** will be required to assure Stanford continues to manage its future research programs in a responsible manner effectively supporting national security efforts.*

Biosecurity – Dual Use Research

*As NSABB recommends that discussion of codes of conduct should be included in any educational program that includes the topics of the responsible conduct of research, biosecurity, and dual use research. It is recommended that **all courses in research ethics and the responsible conduct of research incorporate topics or modules addressing the issues of biosecurity and the dual use implications of life sciences research.***

Safety Risk-Reduction Initiatives

Indicated by the University's worker compensation trends from 1997-2011, increases in occupational injury/illness incidence are currently being experienced, w/ an average annual increase in worker compensation cases of 9% over the past five years. Due to factors including recent campus-wide downsizing, magnified by the demographics of an aging workforce, Stanford's higher loss rates are not likely to recede in the near future without further re-dedication to workplace risk-reduction efforts.

PROGRAM NEEDS

Safety Risk-Reduction Initiatives

Anticipated areas of program focus for the near-term future are as follows: Development and support of campus-wide initiatives to help departments locally cultivate safety cultures targeting more sustainable and healthier work populations. Projects in various stages of development include: 1) Principal Investigator and supervisor safety toolkits and workshops; and 'Safety Scorecard' program whereby upper management of schools and major departments can be apprised of local safety trends/ metrics. Partnering with University management groups, to garner leadership support for promoting research/ general safety as an operational priority and an institutional value.

Expanding Health and Safety Coverage to New and Existing Facilities

OHS anticipates an increase in needed service coverage due to the following.

Increase in Teaching and Research Facilities

The University continues its aggressive pace with ongoing expansion of teaching and laboratory research facilities on- and off-campus. In the past year, Lokey Stem Cell Research Building (known as 'SIM-1') was a major expansion in the School of Medicine (SOM) in addition to recent/ ongoing development of the new Science and Engineering Quad. In addition, expansion of research facilities off-campus is also a newer trend that has been seen particularly with research in the SOM.

Abatement and Decommissioning

The improving economy has resulted in an increase in the number of both small and capital renovation and construction projects that include but are not limited to major replacement of underground utilities distribution systems, structural demolitions, renovations, and large-scale deferred maintenance projects.



PROGRAM NEEDS

Expanding Health and Safety Coverage to New and Existing Facilities

Increase in Teaching and Research Facilities

This growth in research and both on and off campus facilities has a direct correlation with the increasing service demand and workload experienced by OH&S programs.

Abatement and Decommissioning

Given the major projects that have been slated for the next five years, a significant amount of EH&S support will be required over that period of time. Asbestos Program is joining the Oracle eAM Work Order System and is scheduled to go live on March 5, 2012. While the system will provide the benefit of enhanced data collection and reporting capabilities it will also significantly increase administrative burden.

On-Site Occupational Health Services

Since assuming responsibility for all Stanford University Workers' Compensation injury/illness claims in January 2009, the current model of care at SUOHC has consistently resulted in lowered overall worker compensation medical and indemnity costs over the last three calendar years. To gain further traction with worker compensation loss control, further program needs have been identified.

PROGRAM NEEDS

On-Site Occupational Health Services

Further cost savings from worker compensation loss are likely to be realized only through improvement of the "return-to-work" program, and through increased departmental accommodation of workers who have temporary work restrictions.

The current space allocation is inadequate for WC injury/illness care provision. Though WC injury/illness clinic utilization rates are stabilizing, we anticipate a significant increase in clinic utilization for medical surveillance in the next year. Further space allocation will be necessary in the next 12 months; in the absence of this, significant delays in care can be expected in both injury/illness care and medical surveillance care.

Operational Space Needs

As EH&S operations have been based at the Environmental Safety Facility at 480 Oak Road for over two decades, and on-campus for over forty years, the University research and campus service communities have been able to rely on convenient access to EH&S services.

PROGRAM NEEDS

Operational Space Needs

Given the potential need to relocate in the near future, OHS has identified its near-term operational space requirements as follows:

Clinic Facilities

- Workplace injury/ illness care provision*
- Medical surveillance/ screening*

Office space

- Staff daily operations
- Ergonomic Product Showroom*
- Recordkeeping documentation storage

Classroom/ meeting facility

- Training provision*
- Client consultation*

Lab space

- Asbestos Program samples analysis
- Respirator fit-testing*
- Storage/ maintenance of industrial hygiene equipment

Secured location

- DEA controlled substance receiving/distribution*

* Indicates need for convenient on-campus location



Program Elements

Overview

General Injury & Illness Prevention	Biosafety	Ergonomics	Facility Construction, Renovation, Maintenance, and Decommissioning	Hazardous Materials Compliance and Management
<ol style="list-style-type: none"> Injury & Illness Prevention Program (IIPP) Accident / Incident / Exposure Reports Cal/OSHA Liaison Worker Compensation Case Management Plans Reviews Facility Design & Construction Standards (FDCS) Development 	<ol style="list-style-type: none"> Biological and r DNA Evaluations Administrative Panel on Medical Human Subjects / Stem Cell Research Oversight (SRCO) (M) Veteran's Administration Palo Alto Health Care System (FAPA) (M) General Biosafety Animal Biosafety Biosecurity Laboratory Animal Occupational Health Program (LAOHP) (M) Bioemergency Response Occupational Health (M) 	<ol style="list-style-type: none"> Training Ergonomics Workstation Evaluations Ergonomic Equipment Recommendations Ergonomic Equipment Reimbursement Fund Program Management Contracted Services for SLAC Ergonomic Risk Reduction Campus Move Assistance 	<ol style="list-style-type: none"> Asbestos Management Lead Management Facilities Decommissioning and Closure Playground Safety Construction Safety 	<ol style="list-style-type: none"> Hazardous Materials Business Plan and Permits Chemical Inventory Information Management Chemical Safety Information Services Life Safety Box Program Chemical Facility Anti-Terrorism Standard (CFATS)
Industrial Hygiene	Laboratory Safety Chemical Hygiene	Safety and Compliance Assistance	Occupational Safety	University Occupational Medicine Health Center
<ol style="list-style-type: none"> Hazard Communication Chemical / Carcinogen Exposure Assessment Personal Protective Equipment (PPE) Respiratory Protection Hearing Conservation Indoor Air Quality (including Mold) Odor Complaints Heat Illness Prevention Medical Surveillance Reproductive / Developmental Hazards Emergency Eyewash / Safety Shower Emergency Response Assistance Project / Product Review Utility Shutdowns in Areas Containing Hazardous Materials Baseline and Follow-up Surveys Monitoring Equipment maintenance Data Management 	<ol style="list-style-type: none"> Chemical Hygiene Plan Laboratory Safety Plan(s) Standard Operating Procedures (SOPs) Exposure Assessments / Medical Monitoring Chemical Hygiene Plan Evaluation Safety and Compliance Site Visits of Laboratories Laboratory Assessments Accident and Incidents (follow-up) Hazard Information (Development and Promulgation) Nanomaterials Toxic Gas (Oversight & Management) Controlled Substances & Precursor Chemicals Select Agent and Toxins Laboratory Ventilation & Engineering Controls Laboratory Plans Review University Policies related to Laboratories 	<ol style="list-style-type: none"> Regulatory Agency Inspections Safety and Compliance Site Visits Health Physics Program Support Training Laboratory Safety Program Support Specialized Support Services to the Department of Chemistry Laboratory Moves (assistance) Special Projects 	<ol style="list-style-type: none"> Slip / Trip / Fall Prevention Confined Space Forklift Safety Ladder, Scaffolding, and Aerial Lift Safety Compressed Air and Gases Machinery and Power Tool Safety Lockout / Tagout Vehicle Safety Electrical Safety Illumination Stairs / Aisles / Walkways / Work areas / Crawl areas Fall Protection Crane Safety 	<ol style="list-style-type: none"> Workers' Compensation Medical Surveillance Medical Records Management Medical Case Management and Return-to-Work Program Support Wellness / Prevention Services Automatic External Defibrillator (AED) Program (Medical Oversight) Education / Teaching Activity SLAC Site Operations



General Injury & Illness Prevention

Purpose	Prevent injuries and illnesses; Investigate workplace injuries, illnesses, and exposures; Represent the University when interfacing with Cal/OSHA; Follow-up on Workers Compensation cases; Design safe facilities / systems that are environmentally sound; and Ensure safe remodels and new construction projects.
Program Elements	Injury & Illness Prevention Program (IIPP) Accident / Incident / Exposure Reports Cal/OSHA Liaison Worker Compensation Case Management Plans Reviews Facility Design & Construction Standards (FDCS) Development
Business Drivers	<ul style="list-style-type: none"> • Injury rates • Incident Investigation Reports • Building remodels and new construction

Injury & Illness Prevention Program

Background

As established by California state law (Senate Bill 198) and regulatory standards (California Code of Regulations, Cal/OSHA, Title 8- Section 3203), all employers shall establish an effective safety program, known as the Injury and Illness Prevention Program (IIPP), to ensure necessary preventive efforts are taken to minimize the risk for injury and illness in the workplace. The OHS Program has developed and actively maintains the University's institutional Injury and Illness Prevention Program (IIPP) to guide SU departments on their comprehensive implementation of hazard control efforts. For more information, refer to <http://iipp.stanford.edu>.

Beyond regulatory compliance, Stanford's primary purpose of establishing an effective IIPP is to drive an ongoing focus with workplace injury and illness loss prevention. Historically, Stanford has had a higher rate of workplace incidents than the national average for U.S. Colleges/Universities (per US Bureau of Labor Statistics), however vigilant safety efforts systemically delivered through the IIPP within this past decade have helped develop a favorable trend towards reduced injury/ illness incidence and severity (refer to Figure 1).

It is important to note the more recent increasing trend in injury/ illness incidence and illustrates the need for ongoing program enhancements. From fiscal years 2007-2011, over 900 of the 2,400 workplace injuries and illnesses at Stanford

have resulted in lost workdays, and have cost the University over \$15.9 million in total incurred costs. As such, continued improvement towards injury / illness loss prevention remain a valued institutional effort. Key elements of Stanford's IIPP are described below.

Program Elements

Written Program

Per Cal/OSHA regulations, the OHS Program has developed and made available a written Injury and Illness Prevention Program (IIPP). The Program meets all the requirements of the standard, which includes: identifying the person responsible for the program and defining key safety responsibilities; establishing a system to communicate

safety and health matters; identifying and assessing potential workplace hazards; investigating injuries, illnesses and exposures; correcting unsafe conditions; and providing training (Reference 8 CCR 3203(a)(1-7))

Program Responsibility

The IIPP outlines the Cal/OSHA-required responsibilities of the Program Administrator, Managers, Supervisors, Employees, and EH&S for establishing and maintaining a safe workplace. The OHS Program is responsible for the institutional program administration and also serves as the University's liaison with Cal/OSHA (Reference 8 CCR 3203(a)(1)).

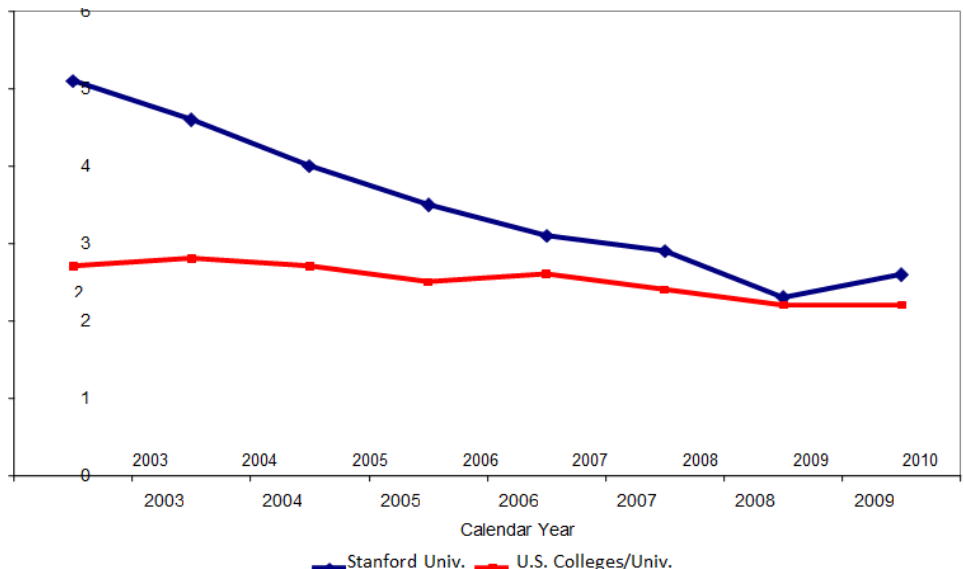


Figure 1
Total Recordable Case Rate (TRC)
Rate per 100 employees



Compliance

To ensure employees comply with safe and healthy work practices per Cal/OSHA, managers and supervisors are responsible for establishing and maintaining good health and safety practices via: Employee recognition for following safe and healthful work practices (e.g., oral acknowledgments at receptions, small gifts such as plaques, etc.); Employee training as necessary/required.; Integration of health and safety practices into new employee job descriptions and performance appraisals; Disciplinary actions when appropriate for failure to follow safe and healthful work practices; and Enforcement of an anti-reprisal policy for employees reporting safety and health concerns (Reference 8 CCR 3203(a)(2)).

Communication

As established in the IIPP and required by Cal/OSHA, Stanford University uses various communication systems to relay pertinent workplace health and safety information to all affected employees. Methods used by the University to convey this information include: Workplace health and safety training; Health and safety publications; Health and safety meetings; University Safety Partners; Research compliance panels; Anonymous and confidential hazard reporting; and an Anti-Reprisal Policy (8 CCR 3203(a)(3)).

Hazard Assessment

Per Cal/OSHA, workplace inspections are to be conducted within department work areas on a periodic basis, whenever new substances/processes/equipment are introduced, or when injuries/illnesses occur. OHS has developed standardized self-inspection forms, checklists and guides to assist supervisors in fulfilling their safety inspection responsibilities. For workplaces with special safety concerns, the OHS Program assists supervisors in identifying and assessing hazards by conducting workplace health and safety surveys which consist of safety evaluations as well as workplace exposure assessments. Where identified using workplace injury/illness statistics, the OHS Program assists specific higher-risk departments in assessing/correcting potential hazards (for example, ongoing custodial ergonomics efforts in Student Housing) (Reference 8 CCR 3203(a)(4)).

Illness and Injury Investigations:

As driven by Cal/OSHA, Stanford's IIPP identifies the required procedures for reporting and investigating occupational injuries, illnesses and exposures. Where needed, the OHS Program provides assistance in investigating and following-up on incidents including chemical exposures, indoor air quality concerns, ergonomics, and safety issues. Follow up may include these steps: Interview of workers and/or witnesses; Exam of workplace for factors associated with the accident/exposure; Determination of possible cause(s); Supervisor takes corrective action to prevent incident from recurring; and Supervisor records the findings and corrective actions. For serious injuries or fatalities, OHS is responsible for reporting the incident to Cal/OSHA and serving as a liaison between the affected department and Cal/OSHA if an investigation is initiated (Reference 8 CCR 3203(a)(5)).

Hazard Correction

Per Cal/OSHA, Stanford University is committed to correcting unsafe or unhealthy work conditions in a timely manner; supervisors are responsible for promptly correcting hazards in their department or shop. As needed, the OHS Program provides technical assistance in implementing corrective actions (Reference 8 CCR 3203 (a)(6)).

Training

To ensure compliance with Cal/OSHA, the OHS Program is responsible to provide technical support and training resources for supervisors and employees. Aside from the general safety guidance, supervisors are responsible for providing hazard- and job-specific training to employees in their shop, work unit or area; many of these courses are made available and provided by the OHS Program (see the section on EHS Training) (Reference 8 CCR 3203(a)(7)).

Future Needs / Challenges

In addition to continued institutional maintenance of the IIPP, OHS continues to develop/ provide tools and services to assist supervisors in fulfilling their workplace health and safety responsibilities.

Accident / Incident / Exposure Reports

Background

Cal/OSHA requires employers to establish an institutional process to investigate workplace injuries, illnesses, and exposures (Reference 8 CCR 3203(a)(5)). The purpose of this review and evaluation process is to assist the supervisor in identifying necessary follow-up items to appropriately to abate the hazard and address root cause(s) of the reported incident. Through this follow-up process, the University reduces the possibility of the accident, incident, or exposure from occurring again. SU-17s also aid in the reporting and corrective actions required by the IIPP.

Program Elements

At Stanford, this process involves departmental submission of the *Incident Investigation Report* (SU-17). The OHS Staff is responsible for reviewing SU-17s and initiating appropriate follow-up as needed. forwards the SU-17s to the appropriate program area (e.g., Biosafety, Health Physics, etc.) for evaluation. The IH Staff is responsible for evaluating SU-17s involving safety issues (slips, trips & falls, back safety), ergonomics, and exposures to chemicals, noise, etc.; these three areas constitute that vast majority of the SU-17s (e.g., 95%).

Cal/OSHA Liaison

OHS staff are the assigned University representative to interface with Cal/OSHA whenever their inspectors arrive onsite for inspection or other information gathering purposes. OHS plays a key role in ensuring that Cal/OSHA compliance visits are carefully expedited to ensure: 1) the University continues to develop its good-faith relation w/ Cal/OSHA whenever opportunities arise; and 2) that the University does not unnecessarily become exposed to more regulatory risk than is due. When an employee lodges a complaint or when Stanford notifies the agency of a reportable serious incident or exposure, a Cal/OSHA compliance officer may make an unannounced inspection (Reference 8 CCR 330). OHS staff interface with Cal/OSHA officials during their inspections by: Escorting the compliance official(s) on the walk-through site visit; Compiling all information



requested during the inspection process; and, Coordinating any requested site inspections or personnel interviews. In cases where citations are levied, EH&S plays a key role in the following processes: Coordinating formal and informal meetings as needed; Facilitating abatement of corrective actions; Submission of required documentation and penalty payment to Cal/OSHA; Facilitating citation appeals processes where appropriate; and Communicating with University counsel.

Workers Compensation Case Management

In some instances when an employee submits worker's compensation paper work for a potential exposure, accident, or incident, the management of the case is protracted despite the efforts of OHS, Risk Management, Human Resources, and Occupational Medicine Department.

One of the main factors in a case becoming complicated stems from the employee's misperception of the hazard, despite a negative hazard evaluation by the IH staff. In some instances, the employee may have certain expectations of the employer (e.g., being released from work even though no occupational health or safety hazard exists). The Human Resource Officer is called upon to assist in managing these administrative factors.

In other instances, the employee's case is prolonged due to the employee's failure to follow-through on treatment, modify work practices, etc.

These cases can absorb significant IH staff time by the need to conduct additional site visits, consult with the treating physician,

prepare additional reports and e-mail correspondence, conduct negative exposure air monitoring for documentation purposes, etc.

Plan Reviews

Background

Safety, health and environmental concerns should be addressed during the planning, design, development, acquisition, fitting-out and operation of systems and facilities and associated modifications. Emphasis should be placed on the use of sound scientific and engineering principles up front during planning, design, and development to identify and control hazardous materials and reduce other hazards associated with facility/system operation and support throughout its life cycle. The primary objective is to design the safe, environmentally sound and cost effective facilities/systems consistent with mission requirements.

Design Reviews

Safety and occupational health aspects should be considered, designed, and engineered into all facilities which are acquired or constructed for use by Stanford employees. Facility design engineers in many instances are not totally familiar with all potential health hazards created by various materials, equipment, and operations used in Stanford facilities, nor are they aware of the special design considerations required to control these hazards. To ensure that appropriate hazard control techniques are applied, industrial hygienists and safety professionals should participate in the review of plans and specifications for these projects. Projects that involve potential health hazards, such as toxic materials, radiation, noise, or other

health hazards, should be designed as required by established principles of good industrial engineering published in texts and standards, such as Industrial Ventilation, A Manual of Recommended Practices, ACGIH; ANSI Z9.2-1979 *Fundamentals Governing the Design and Operation of Local Exhaust System*; CFR 29, Chapter XVII, 1910; and etc.

Future Needs / Challenges

Currently, staff time dedicated to this task is increasing and it is expected that the OHS staff will take on an even larger role in this area especially in specialty laboratory issues such as toxic gas.

Facility Design & Construction Standards (FDCS)

The Facility Design & Construction Standards (FDCS) are guidelines and specifications which project managers and their consultants and contractors are to follow during remodeling and new construction projects on campus. The OHS Program develops sections for inclusion in the FDCS standards; examples of guidelines brought forward by the OHS Program include: laboratory design standards, ergonomic standards for furniture, emissions standards for furnishings and major construction materials that may impact the Indoor Air Quality from recently renovated facilities, etc. In addition to keeping existing standards updated, the OHS Program is involved in any necessary future standards development which have health/safety elements.

Biosafety

Purpose	Regulate use of biohazardous materials (BSL2/3), synthetic nucleic acids and rDNA; Provide oversight of use of biohazardous materials for use with humans, animals or stem cells; Address health risks associated with animal research; Investigate accidents , injuries, illnesses / exposures; Respond to bioemergencies and biological threats to public health; Manage occupational health programs related to biological materials (e.g., Bloodborne Pathogens, Aerosol Transmissible Diseases, Medical Waste Management, etc.).
Program Elements	Biological agent and rDNA Evaluations Administrative Panel on Biosafety/Research Compliance for use of biological agents and rDNA Veteran's Administration Palo Alto Health Care System (FAPA) (M) General Biosafety Animal Biosafety Biosecurity Laboratory Animal Occupational Health Program (LAOHP) (M) Occupational Health (M) Bioemergency Response Biomedical waste
Business	<ul style="list-style-type: none"> • Biohazardous materials, Molecular biology research (rDNA), and Xenograft studies • Animal Biosafety Level (ABSL) development



Drivers

- Shipping regulations

The Stanford University Department of Environmental Health and Safety, through the Biosafety Program, is responsible for monitoring individual principal investigators, staff and students, and laboratory facilities for the safe storage, use, handling and disposal of biohazardous agents and recombinant DNA. The program monitors and interprets existing and proposed biosafety laws, regulations, standards and guidelines.

The requirement for authorization of a Biosafety Officer/ Manager at Stanford University is found in the [NIH Guidelines](#) (May 2011) Guidelines for Research Involving Recombinant DNA Molecules, section entitled “Biological Safety Officer (BSO)” [Section IV-B](#) states, “The institution shall appoint a Biological Safety Officer if it engages in recombinant DNA research at BL3 or BL4 or engages in large-scale (greater than 10 liters) research. The Biological Safety Officer shall be a member of the Institutional Biosafety Committee.”

Additionally, the Stanford University Charge to the Administrative Panel on Biosafety requires all activities involving the use of Biosafety Level 2 or 3 agents (Biohazardous agents) to be reviewed by the panel. Failure to follow Stanford University's own internal mandates would put it into jeopardy with the Department of Health and Human Services (HHS). Currently there are over 500 applications for biological research approved by Stanford University's Institutional Biosafety Committee (IBC) known locally as the Administrative Panel on Biosafety (APB).

The biosafety program represents Stanford University at the Federal level (CDC, NIH, FDA, Office of Science and Technology Policy) regarding Biosafety and Biosecurity, including providing responses to influence legislative bodies on behalf of Stanford. Additionally, the program must maintain and update information on Biosafety laws, Biosecurity, regulations, guidelines and standards per federal, state and local mandates. New regulations and legislation must be monitored and analyzed as they occur. Oversight of Stanford operations by Biosafety can be divided into two sections - research review (Sections A

- E) and programmatic support (Sections F - M). Research review involves areas directly related to laboratory research, including research compliance panels, funding agency requirements, and human/animal research using materials regulated by the NIH Guidelines. Programmatic support supplied by Biosafety addresses sections such as Medical Waste, Shipping requirement and facilities. Each area may have specific training requirements that are addressed.

Biological and rDNA Evaluations

Background Regulatory Policy. The CDC/NIH Publication entitled [Biosafety in Microbiological and Biomedical Laboratories](#) (BMBL) (2009) defines the principle of biological containment and biosafety levels for laboratories and biological organisms. The primary guideline for the use of recombinant DNA molecules is the [NIH Guidelines](#) (May 2011) Guidelines for Research Involving Recombinant DNA Molecules. This guideline and the CDC/NIH reference BMBL will be used to evaluate all non-exempt recombinant DNA (rDNA) experiments.

Administrative Panel on Biosafety (APB) Protocol Review

The Administrative Panel on Biosafety meets every month to discuss, evaluate and review biohazardous agent use involving Biosafety Level 2 or 3 agents, non exempt recombinant DNA molecules and clinical protocols using recombinant DNA or biohazardous agents. The APB and Biosafety personnel consider the following factors when evaluating the use of biohazardous agents or recombinant DNA molecules: 1) Training of the laboratory staff workers; all laboratory workers who must work with biohazardous materials are required to receive training in the safe handling and disposal of these materials ([NIH Guidelines Section IV-B-3-c-\(5\), Section IV-B-1-h](#)). There is a comprehensive biohazard training available on line through the University and additional training is done as needed by the Biosafety staff; 2) Availability of containment equipment such as a biosafety

cabinet ([NIH Guidelines, APPENDIX G-II-B-3](#)) ([BMBL, Section III](#)); 3) Availability of appropriate personal protective equipment for workers who must handle biohazardous materials ([NIH Guidelines, APPENDIX G](#)); 4) Transportation of the biohazardous material from the lab facility and through the building to tissue culture rooms or storage areas; 5) Shipping and importation of the biohazardous material to the lab facility ([BMBL, Appendix C](#)); 6) Emergency procedures ([BMBL, Section II](#)); 7) Decontamination procedures for spill clean-up, injury or other emergency incidents ([BMBL, Appendix B](#)); 8) Biohazardous waste must be segregated at the point of generation and disposed of properly ([NIH Guidelines, Appendix G](#)); 9) Medical surveillance, if available and/or necessary ([NIH Guidelines, Section IV-B-1-I, BMBL, Section VII](#)); 10) Use of animals which would require approval by the University Administrative Panel on Laboratory Animal Care ([NIH Guidelines, Appendix Q](#)); 11) Use of animals with recombinant DNA-modified microorganisms ([NIH Guidelines, Section III-D-4](#)); 12) Use of human subjects which would require approval by the University Administrative Panels on Human Subjects (also known as the IRB) ([NIH Guidelines, Appendix M](#)); and 13) Use of human stem cells which might require approval by the University Administrative Panel for Stem Cell Research Oversight ([NIH Guidelines, Section III-D-1-a](#)).

Biosafety Personnel Initial Review of Biosafety Application Forms

Biosafety Personnel are responsible for obtaining adequate information for the Administrative Panel on Biosafety (APB) review at the monthly Panel meeting. The evaluation of any APB application form is based on the biohazardous agents used, the recombinant DNA host vector system and what procedures will be carried out. In the course of conducting a review of a proposed APB application form, Biosafety Personnel will: 1) Check available literature on the nature of the biohazardous agent/rDNA used; 2) Request applicable scientific literature regarding the biohazardous agent/rDNA from the Principal Investigator in order to present concise background information to the



Panel; 3) Review the proposed experimental procedures and note any high risk procedures such as use of sharps or the generation of aerosol droplets; 4) Ensure that the investigator will dispose of medical and other regulated waste in an appropriate manner; 5) Ensure that the investigator's work practice, use of engineering controls and use of personal protective equipment is adequate for the procedures performed; 6) Evaluate the disinfectant selected for the proposed experimental work; 7) Assess the availability of vaccinations and other medical surveillance appropriate for the proposed work; 8) Recommend a Biosafety Level for the proposed experimental work; 9) Inspect the listed lab rooms to ensure that adequate containment appropriate for that biosafety level is available; 10) If necessary, meet personally with the Principal Investigator or his/her designee to discuss any findings noted during the lab walkthrough and any questions which have arisen after the Biosafety Personnel review of the APB Application Form; 11) Prepare a summary evaluation of the proposal to present to the APB at the monthly meeting; and 12) For review of Human Gene Transfer protocols, the Biosafety Personnel will do a thorough literature review and contact technical experts as necessary. Post APB meeting: If any conditions for approval are made by the APB at the meeting, Biosafety personnel will discuss these with the Principal Investigator to expedite final approval. For more information about the APB evaluation process refer to the flowchart.

Biovisits

The *NIH Guidelines* ([Section IV-B-3-c-\(1\)](#)) requires periodic inspections by the Biosafety Officer of laboratories under the purview of the APB. Biosafety personnel carry out Biovisits, which provide on-site appraisal and verification of personnel and project specific issues. Biovisits are tied into the APB cycle, with a visit prior to panel discussion for an initial protocol submitted. Additional Biovisits are done to correspond to annual renewals and revisions including additions of new biological agent(s), in vivo research, new locations, or new experimental procedures.

In addition to assisting a Principle Investigator with the preparation of the APB protocol, Biovisits provide verification that lab personnel are knowledgeable in both theory and practice for working with biohazards. Biosafety personnel discuss the following information during the visit:

- Potential hazards of the Biological agents during in vitro and in vivo research
(Virulence and pathogenicity of the organism(s); and Principal exposure routes during the manipulation and production of agents)
- Control measures and laboratory practices to be implemented to reduce the risk of potential hazards
(Emphasis on Personal Protective Equipment that will protect the researchers during the handling of Biological agent(s); Demonstrate proper laboratory practices, including working within a Biosafety Cabinet; Discuss safety precautions to be used during centrifugation, homogenizing cells, injecting transduced target cells or virus into animals via stereotactic procedure or tail vein injection, sorting of viable transfected cells and other special procedures that could possibly create exposure risks such as aerosols or handling of sharps; Explain storage and handling requirements for the biological agents; Ensure implementation of deactivation procedures and disposal of biohazardous materials as required by Santa Clara County and NIH, and as approved by the APB; Explain procedure in case of an incident or exposure; and Confirm proper signage and Biohazard placards posted to ensure awareness of Biological Agent(s) usage in the area)
- Transportation procedures for Biological agents or infected materials
(Internal transportation; and Shipping requirements)

Reporting (M)

The *NIH Guidelines* ([Section IV-B-1-j](#)) requires the APB to report any significant

problems, violations of the *NIH Guidelines*, or any significant research-related accidents and illnesses to NIH/OBA within thirty days. The Biosafety program investigates incidents involving rDNA and/or infectious agents and coordinates the report with the APB.

Administrative Panel on Medical Human Subjects / Stem Cell Research Oversight (SRCO) (M)

Background

Regulatory Policy. The University's Institutional Review Board (IRB) and Stem Cell Research Oversight (SCRO) Panel reviews the conduct of research involving human stem cells is governed by policy, incorporating U.S., State of California, and California Institute for Regenerative Medicine (CIRM) regulations. The primary guideline for the use of recombinant DNA molecules is the NIH Guidelines APPENDIX M.

Key activities

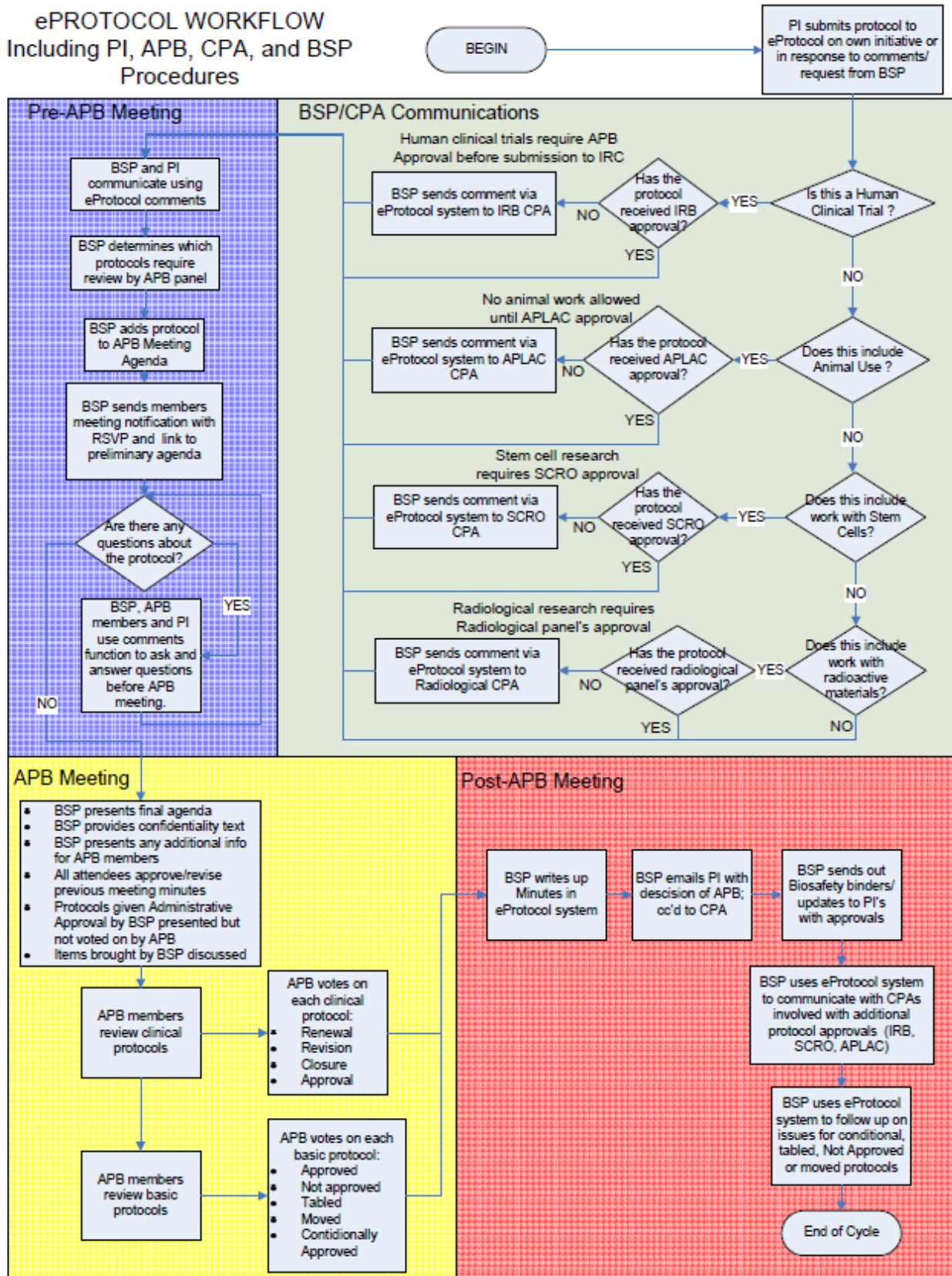
The Biosafety Manager is an ex-officio member of the SCRO. The Manger (or a Biosafety alternative) coordinates communication between the APB and SCRO. An important part of this coordination is APB/SCRO cross-reviews; this occurs when a researcher plans on using rDNA/biohazardous agents in human stem cells. This process assures that both protocols contain the same following items: 1) Personnel (training, authorization, medical surveillance); 2) Biohazardous agents; 3) rDNA; and 4) Laboratory requirements.

Future Needs / Challenges / Regulatory Trends

Due to the technical knowledge (biohazardous agents, rDNA, laboratory requirements) required to review the APB portion of these protocols, Biosafety staff do all of the cross-review process for both panels. In 2011 approximately 35 SCRO protocols underwent cross-review by Biosafety. Changes in stem cell regulation should not affect review by the APB.



ePROTOCOL WORKFLOW
Including PI, APB, CPA, and BSP
Procedures





Veteran's Administration Palo Alto Health Care System (VAPA)(M)

Background

Regulatory Policy. Stanford University has an agreement with the VAPA and the Palo Alto Institute for Research and Education, Inc. ("PAIRE"), which applies to all research involving the use of biohazardous agents and recombinant DNA molecules that require APB approval, and all other activities which even in part involve such research, regardless of whether the research is otherwise subject to VA regulation, if: 1) the research is sponsored by the VA, or 2) the research is conducted using any property or facility of VAPA.

The VAPA registers the Stanford University APB as the IBC on record with NIH OBA. As such, the APB is responsible for the initial and continuing review of all VA research involving the use of biohazardous agents and recombinant DNA molecules that require IBC approval. This designation gives the APB authority to take any action necessary to ensure proper safety procedures are followed when Biosafety level two or non-exempt recombinant DNA molecules are utilized in VA research studies. The APB has the authority to approve, require modifications in, or disapprove use of biohazardous agents and recombinant DNA molecules in VA Research. Research applications to use the covered items are submitted to the APB via the same system of review that all applications use. As consideration for the services provided by Stanford, PAIRE agrees to pay Stanford via transfer of expense initiated by Stanford's Department of Environmental Health and Safety (EH&S) on a quarterly basis. The amount charged is calculated using EH&S's current charge-out rate for Biosafety services multiplied by the number of hours EH&S Biosafety Program staff work on VA research.

Key activities

The VAPA Subcommittee on Research Safety meets every month to discuss, evaluate, review and inspect VAPA Research Projects, biohazardous agent use involving Biosafety Level 2 or 3 agents, non-exempt recombinant DNA molecules and clinical protocols using recombinant DNA or biohazardous agents. A Stanford

member of the Biosafety program is a voting member of the Subcommittee. The Subcommittee ensures the following are addressed during the review process and laboratory inspections of the projects: 1) Training of the laboratory staff workers; all laboratory workers who work with biohazardous materials are required to receive training in the safe handling and disposal of these materials. There is comprehensive biohazard training available on line through the University and additional training is done as needed by the Biosafety staff; 2) Availability of containment equipment such as a biosafety cabinet; 3) Availability of appropriate personal protective equipment for workers who must handle biohazardous materials; 4) Transportation of biohazardous material from the lab facility and through the building to tissue culture rooms or storage areas; 5) Shipping and importation of the biohazardous material to the lab facility; 6) Decontamination procedures for spill clean-up, injury or other emergency incidents; 7) Use of animals which would require approval by the VA Palo Alto Institutional Animal Care and Use Committee (IACUC); 8) Biohazardous waste must be segregated at the point of generation and disposed of properly; and 9) The availability of vaccinations or other medical surveillance appropriate for the research work. VA Palo Alto Institutional Animal Care and Use Committee (IACUC) meets every month to discuss, evaluate, reviews VA Palo Alto Research Projects. A Stanford member of the Biosafety program is an ex-officio member of the IACUC and performs the following: 1) Review Animal protocols and make sure that an APB approved protocol is noted in the animal protocol application; 2) Recommend a Biosafety Level for the proposed animal experimental work; 3) Ensure that APB approved protocol is completed prior to animal work begins; 4) Train researchers (ABSL2 training) who will be doing the animal research; and 5) Ensure researchers will follow appropriate laboratory practices and use personal protective equipment for the approved procedures.

Future Needs / Challenges / Regulatory Trends

The amount of time required for coverage of the VAPA has been increasing over the past few years, leading to a larger percentage of available time for a Biosafety presence at the VAPA location.

The VAPA is currently re-evaluating its internal research oversight procedures, and as such, Biosafety will determine if any changes are needed to continue appropriate oversight.

General Biosafety

The Biosafety program reviews research proposals and material requests regarding biosafety issues for the University. Review of these items is coordinated with APB submission as needed.

Background

Regulatory Policy. The CDC/NIH Publication, [Biosafety in Microbiological and Biomedical Laboratories](#) (BMBL) (2009) defines the principle of biological containment and biosafety levels for laboratories and biological organisms. The primary guideline for the use of recombinant DNA molecules is the [NIH Guidelines](#) (May 2011) Guidelines for Research Involving Recombinant DNA Molecules. This guideline and the CDC/NIH reference BMBL will be used to evaluate all non exempt recombinant DNA experiments.

Key activities

Fellowships (M)

Post-doctoral fellows that apply for funding to support their research at Stanford often require supporting documentation concerning compliance with NIH and private granting agency requirements with regards to Biosafety. The program works with the fellows, reviewing their proposed research and preparing documentation to supply the funding agencies.

Grants

Either at the time of application or prior to funding, PIs are often required to present proof of compliance with Biosafety regulations. The program works with the investigators, reviewing their proposed research and preparing documentation to supply the funding agencies. The Biosafety program also oversees compliance with Department of Defense (DOD) requested institutional compliance information.

Material Transfer Agreements (MTAs) (C)

Stanford University's Industrial Contracts Office handles requests from



Stanford researchers that require biological material from outside sources; these requests require the use of an MTA. The Biosafety program reviews all MTAs that include rDNA and/or biological agents; approval for non-exempt material is required prior to an investigator receiving that material.

Future Needs / Challenges / Regulatory Trends

The number of MTA requests continues to rise as molecular biology (rDNA) becomes increasingly vital for many branches of research. In 2010 Biosafety reviewed 242 MTAs, more than twice the number reviewed in 2007. To address the continued growth in MTA reviews, Biosafety is working with the Industrial Contracts Office to provide education and guidance on Biosafety issues. This is currently an on-going trial to assess the potential of MTA personnel to review Biosafety issues and remove some of the review burden currently present on the Biosafety staff. The above mentioned trial will be evaluated for affectivity; if it is not shown to be affective, additional Biosafety personnel time for these reviews will be required to continue meeting these programmatic needs.

Animal Biosafety (M)

Animal Biosafety Level (ABSL) Facilities

Background

Regulatory Policy. The [NIH Guidelines](#) (May 2011) [Appendix Q](#) defines the containment level requirements for research involving Recombinant DNA and biological agents in association with animals. The [BMBL](#) ([Section V](#)) defines the principles of biological containment and biosafety levels for animal facilities for laboratories working with biological agents in animals.

Key Activities / Current Activities

Biosafety personnel are involved with members of the Veterinary Service Center (VSC) and APLAC in the quarterly inspections of ABSL-2 housing and procedure areas and are involved in evaluating proposed animal procedure and animal housing rooms to ensure that they meet the criteria for work at ABSL-2 or above. Evaluation of the current facilities that use biohazardous materials includes checking for the following engineering and

procedural policies: Availability of hand and eye washing facilities ([BMBL](#), [Section V](#)); Biosafety cabinets ([NIH Guidelines](#), [Appendix G](#), [Section G-II-B-3](#)); Availability of PPE ([NIH Guidelines](#), [Appendix G](#), [Section G-II-B-2-f](#)); Training of employees ([BMBL](#), [Section V](#)); and Biohazardous waste disposal ([NIH Guidelines](#), [Appendix Q](#), [Section Q-II-B-1-b](#) and [Q-1-B-1](#)).

The Biosafety Manager is an ex officio member of the Administrative Panel on Laboratory Animal Care (APLAC) and performs cross panel reviews of APLAC protocols involving the use of biohazardous materials in animals. These cross panel reviews ensure that the PI has both APB and APLAC approval to work with biohazardous materials in animals and that the agents, the procedures, locations and personnel are listed and are the same on both the APLAC and APB protocols.

Future Needs / Challenges / Regulatory Trends

Biosafety can and will continue to provide insight and recommendations to the VSC on the use of and need for ABSL-2 housing areas. When new spaces for ABSL-2 procedures and housing are developed, Biosafety will continue to provide recommendations on the use of the space to ensure that the space meets the criteria for work at ABSL-2. In the event that there is an increased need for ABSL-2 housing and the development of new biohazard suites, Biosafety should be involved in the planning of these spaces with the VSC. As Stanford continues to recruit new faculty, some of whom may be interested in pursuing research in animals with BSL-3 agents, new facilities to accommodate research at the ABSL-3 level will need to be designed and Biosafety will provide guidance and recommendations in the development of ABSL-3 housing as needed.

Animal Biosafety Level Training (M)

Background

Regulatory Policy. The [NIH Guidelines](#) (May 2011) [Appendix Q](#) and the [BMBL](#) ([Section V](#)) defines the needs for ABSL-2 and higher training for laboratories working with biological agents in animals.

Key Activities / Current Activities

Animal Biosafety Level 2 (ABSL-2) training is a combination of online material

with in-person project specific training done in co-ordination with the Veterinary Service Center (VSC). The in-person training for research personnel working with biohazardous materials in animals is done by researchers who will be working with the agents meeting with a biosafety official, a member of the veterinary staff, the supervisory caretaker for the biohazard suite and the training co-coordinator for the VSC. The training covers: Safe practices specific to the particular research study and the Stanford Animal facilities ([NIH Guidelines](#), [APPENDIX Q](#), [Section Q-III-A](#)); General Animal Biosafety Precautions ([BMBL](#), [Section V](#), [Animal Biosafety Level 2 \(A\)](#)); The type of PPE required ([NIH Guidelines](#), [Appendix G](#), [Section G-II-B-2-f](#)), [BMBL](#), [Section V](#), [Animal Biosafety Level 2 \(A\) 7](#), ([BMBL](#), [Section V](#), [Animal Biosafety Level 2 \(C\)](#)); Appropriate Biohazard identification at the room level and at the cage level ([BMBL](#), [Section V](#), [Animal Biosafety Level 2 \(A\) 5](#)); Transport of animals and/or materials ([BMBL](#), [Section V](#), [Animal Biosafety Level 2 \(A\) 15](#)); Special Husbandry Requirements ([BMBL](#), [Section V](#), [Animal Biosafety Level 2 \(A\) 3](#)); Waste disposal ([NIH Guidelines](#), [Appendix Q](#), [Section Q-1-B](#)), ([BMBL](#), [Section V](#), [Animal Biosafety Level 2 \(B\) 3](#)); Emergency Procedures ([BMBL](#), [Section V](#), [Animal Biosafety Level 2 \(A\) 5](#)); and Recommended Medical Surveillance ([BMBL](#), [Section V](#), [Animal Biosafety Level 2 \(A\) 4](#)).

Future Needs / Challenges / Regulatory Trends

As new members of a lab join and participate in research using animals at BSL-2, it is important for them to be trained in the specific agent/areas that they will be working with. In the future, switching to an online training module that covers the basic safety information for the various agents (viral vectors, bacterial agents, and viral agents) could serve the same purpose that the in-person training currently serves and thus create a more efficient method for providing ABSL-2 training to new researchers. In-person training would still be available to address specific and unique situations, but the basic information could be compiled into online



modules based on agents and locations. To help compliance with completion of ABSL-2 training, Biosafety will explore the potential of using the Stanford on-line training system (STARS) as a platform for the animal biosafety training. This training module would need to be developed and Biosafety would work with the VSC to create this new training.

Transduced / Transformed Cells, Transgenic Animals, Xenografts (M) **Background**

Regulatory Policy. The [NIH Guidelines](#) (May 2011) Section III-F regulates experiments involving the generation of Transgenic Animals and Section III-D regulates the use of virally transformed cells and xenografts in animals

Key Activities / Current Activities

Currently animals that have been implanted with virally transduced cells are housed in one of the ABSL-2 suites during the 48 hour shedding period. At that point, the animals can be moved to normal ABSL-1 housing, with the approval of the VSC. Animals that have been implanted with primary human tissues (xenografts) are handled using Universal Precautions, but there is currently no requirement or guidelines for these animals to be housed at ABSL-2. Many researchers currently house these animals at an enhanced ABSL-1 level, meaning that they animals are housed in ABSL-1 animal rooms, but are handled using ABSL-2 practices (universal precautions). Biosafety and the APB are working in conjunction with the VSC to create better guidelines regarding the housing requirements for investigators working with xenografts of primary cell tissue samples in animals. The housing recommendations for xenografts depend on: Health Status of the Donor (if known); Testing of the samples for human BBP; Ability of the tissue samples to support replication of BBP; and Ability of host animal to support replication/shedding of infectious agents. (e.g. humanized rodents).

Future Needs / Challenges / Regulatory Trends

As the number of researchers using animals for xenograft studies increases, the need to determine the housing requirements for these animals continues to grow. Biosafety and the APB will continue to work with the VSC to create guidelines

regarding the housing requirements for investigators working with transduced cells in animals, as well as for xenografts of primary cell tissue samples. Biosafety will work with the VSC to evaluate the current housing areas for xenograft work to determine if they are appropriate for working with these types of animals using Universal Precautions, and if necessary make recommendations to the VSC about the creation of additional enhanced ABSL-1 animal rooms appropriate for xenograft work.

Biosecurity

Dual Use Research

Background

Regulatory Policy. The National Science Advisory Board on Biosecurity (NSABB) is a federal advisory committee chartered to provide advice, guidance, and leadership regarding biosecurity oversight of dual use research, defined as biological research with legitimate scientific purpose that may be misused to pose a biologic threat to public health and/or national security.

Key Activities / Current Activities

Synthetic Biology

There are potential biosecurity risks associated with synthetic biology, and in particular, the concern that synthetic biology offers an opportunity for the synthesis or re-design of harmful pathogens that could be used to threaten public, plant or animal health. The following recommendations, made by the NSABB, are applicable to Stanford University: Synthetic biology should be subject to institutional review and oversight since some aspects of this field pose biosecurity risks; and Outreach and education strategies should be developed that address dual use research issues and engage the research communities that are most likely to undertake work under the umbrella of synthetic biology.

Dual Use Research

Dual Use Research describes biological research yielding information and technologies with the potential to be misused to pose a biologic threat to public health or national security. The [National Science Advisory Board for Biosecurity](#) (NSABB) was established in 2004 to address issues of Dual Use and

provide advice and guidance. In September 2011 the NSABB released a report, [Guidance for Enhancing Personnel Reliability and Strengthening the Culture of Responsibility](#), stating recommendations for institutions working with biological agents, including Select Agents. The following summary reflects recommendations regarding awareness and conduct as related to research not involving Select Agents (Stanford does not currently have research using viable Select Agents): It is recommended that all courses in research ethics and the responsible conduct of research incorporate topics or modules addressing the issues of biosecurity and the dual use implications of life sciences research. The NSABB recommends that discussion of codes of conduct should be included in any educational program that includes the topics of the responsible conduct of research, biosecurity, and dual use research.

Future Needs / Challenges / Regulatory Trends

To the extent that synthetic biology may present biosecurity or dual use research concerns, the NSABB has proposed an oversight paradigm that should adequately address such issues, but there is currently no federal policy in place for the review and conduct of dual use research of concern. The scope of recommendations from the NSABB would broaden if Stanford University carries out research on viable Select Agents or toxins above the exempt level.

Laboratory Animal Occupational Health Program (LAOHP) (M)

Background

Regulatory Policy. The LAOHP dovetails with Stanford University's Injury, Illness Prevention Program (IIPP). Mandated by federal requirements ([Public Health Service](#) (PHS) [Office of Laboratory Animal Welfare](#) (OLAW)) and external laboratory animal care accreditation agencies (Association for Assessment and Accreditation of Laboratory Animal Care International ([AAALAC](#))), the primary goal of the LAOHP is to evaluate and, if necessary, address potential health risks to researchers that may be associated with the



use of animals in the research environment. University policy requires that all faculty, staff, visiting scholars, and students who work directly with vertebrate animals, unfixed animal tissues or body fluids, and those who work in animal housing areas must participate in the LAOHP. The purpose of the Laboratory Animal Occupational Health Program (LAOHP) is to: Protect individuals from work-related risks associated with research on animals; and protect the health of research animals from certain transmissible diseases. The LAOHP is specific to the researchers' work and the species to which they are exposed while being minimally intrusive and cost-effective. This program is relevant to faculty, staff, visiting scholars, and students who use vertebrate animals in research or teaching activities. The two major functions of the Program are: 1) Prevention and monitoring of potential work-related exposures to laboratory animals, as well as other hazardous materials (e.g., chemical, biological, radiological and physical stressors); and 2) Occupational injury and illness treatment when work-related injuries and illnesses are identified.

Key Activities / Current Activities

Mandated by federal requirements and external laboratory animal care accreditation agencies, the primary goal of the LAOHP is to evaluate and address potential health risks to researchers that may be associated with use of animals in the research environment. The Biosafety Program, working with the Industrial Health professionals in EH&S, provides information and recommendations concerning infectious agent use in animals. Biosafety additionally coordinates LAOHP enrollment data between APLAC and SUOHC.

Participation in the LAOHP program involves the following: Receipt of programmatic information; Completion of an occupational health surveillance questionnaire (required for Risk Category 1 personnel, optional for Risk Category 2 personnel); Completion of any additional medical surveillance requirements identified by the Occupational Physician; and Additional training, if work involves non-human primates, pregnant or neonatal sheep.

Risk Category 1 (RC1)

Risk Category 1 is considered higher risk and encompasses: Veterinary Service Center (VSC) personnel and other dedicated animal care staff; Individuals who work with non-human primates (including unfixed tissue and bodily fluids), hoofed mammals (e.g., swine, goats, sheep, cows), wild rodents, and certain field studies; and The specific risk factors are variable and dependent upon specific uses and handling identified in the animal care and use protocol application.

Risk Category 2 (RC2)

Involves: All Persons involved in animal care and use protocols that do not fall within the RC1 category; and RC2 personnel are provided with information, educational materials and periodic updates on potential health and safety issues associated with the particular animal species or research material with which they work. These individuals are strongly encouraged to complete and submit the LAOHP Health Questionnaire, but are not required.

Training

Non-human primate (NHP) Training: Personnel who work with NHP's are expected to attend a focused training session provided by the Department of Comparative Medicine/Veterinary Services on the following topics: laws, regulations and guidelines for using primates in research; bacterial, viral and protozoa pathogens that may infect humans; human diseases that can be anthroponotic; proper handling of NHP's and appropriate personal protective equipment; procedure for dealing with a bite, scratch, needlestick or other exposure involving primates; and proper waste disposal and decontamination procedures.

Special Seminars and Training Sessions

Specialized trainings outside of routine EH&S course offerings are provided by EH&S staff, Stanford University Occupational Health Center, Veterinary Service Center staff, locally by the School of Medicine, and others as needed. Examples of training topics include: *Toxoplasma gondii* – Training for researchers working with *T. gondii* in rats and/or mice; *Vaccinia virus* – Provided to individual labs and Veterinary Service Center staff as needed; *Coxiella burnetii* (Q Fever) – Training developed by collaborative effort

between VSC, EH&S, Occupational Health Center; N95 Respirator Training for Sheep Users; Back Care and Ergonomics Awareness at the VSC – Specialized ergonomics training designed for animal care handlers and other VSC staff; and New Principal Investigator Training Provided by School of Medicine.

Occupational health and safety surveys of VSC

EH&S developed *Guidelines for Minimizing Occupational Exposures to Hazardous Chemicals* for use by researchers and VSC staff. Training and Medical Surveillance requirements for each job classification were provided in the reports. Additionally, the Occupational Health and Safety Program within EH&S conducted a baseline Industrial Hygiene/Safety/Biosafety survey of the VSC. Industrial Hygiene surveys occurring since completion of the baseline are listed below.

- Air Monitoring Results for Isoflurane During Mouse Ear Measurements
- Air Monitoring Results for Isoflurane During Mouse Surgery
- Air Monitoring Results for Isoflurane During Mouse Craniotomies
- Handling Adriamycin by Researchers and the Veterinary Service Center Husbandry Staff
- Recommendations for APLAC Committee Reviews; Review of Animal Protocols using Chemical Agents
- Air Monitoring Results for Halothane During Owl Surgery
- Air Monitoring Results for Halothane During Rabbit Surgery
- Review of MPTP Protocol, 2nd Draft

Surveillance & Safety information

Depending on the animal species planned for use, researchers may be required to complete a health history questionnaire. Each questionnaire is evaluated by the Stanford University Occupation Health Center to determine the individual's level of potential health risk and whether further precautions are necessary. The Department of Comparative Medicine and APLAC have prepared informational brochures that describe common risks involved with animal exposure; these are provided to individuals who participate in the LAOHP.

Continuous outreach is conducted by EH&S for all personnel listed on



APLAC protocols. This is accomplished through a combination of live information sessions and email outreach to personnel through assorted VSC/APLAC lists.

Medical Assessment / Communication of Risk

Health history information gathered as part of the LAOHP is assessed under the direction of the medical provider to identify potential exposure to hazardous agents. As indicated, preventative follow-up care will be provided (e.g., tetanus boosters, rabies titer determination, Hepatitis B immunization, hearing screening, etc.). Participants in the LAOHP who have primate exposure will be subjected to Quantaferon testing (or appropriate alternate monitoring in the case of known reactors) on an annual basis.

Consultation

If medical conditions which may predispose the individual to allergic reactions, infectious disease, ergonomic problems or other physical disabilities are noted in the questionnaire, the provider will discuss the issues with the person at risk to be sure they understand the risks. The individual will be advised to take appropriate measures to avoid potential health risks. Supplemental information or education may be provided. Any individual who has concerns about the content of the questionnaire or work-related health risks associated with working with animals, unfixed tissues, or body fluids, is encouraged to discuss these concerns with the medical provider during a private interview.

Accidents, Injuries, Exposures, and Illnesses

Stanford University reviews all occupational injury or illness and provides follow up, as necessary. Employees are instructed to report accidents/exposures to the supervisor as soon as possible. The supervisor contacts EH&S. An investigation team consisting of an occupational health & safety specialist, chemical waste specialist, environmental specialist, biosafety officer, radiological safety specialist, and fire marshal is available, as needed. In some cases EH&S may report the injury or illness to Cal-OSHA.

Future Needs / Challenges / Regulatory Trends

It is anticipated that the program will move away from a paper-based program to a web-based one; this will help ensure enrollment and increase communication between all the participants that are involved (APLAC, RAF, SUOHC, Biosafety).

Bioemergency Response

A combination of the Anthrax attacks in 2001, SARS in 2003 and the potential of new and reoccurring community diseases (Pandemic Flu, Avian Flu, etc) has increased the need for prompt responses to bioemergency and bioterrorism issues. These issues include awareness and education, along with the ability to respond to fast arising situations.

Bioterrorism (D)

A bioterrorism attack is the deliberate release of biological agents used to cause illness or death in people, animals, or plants. Biological agents can be spread through the air, through water, or in food. The Biosafety program supports responses by supplying educational information to the Stanford community. Additionally, the program helps to identify specific needs necessary to maintain the health, safety and functionality of the campus in case of an event. These needs include identification of Personnel Protective Equipment (PPE), assessment of quantities needed and preparation of educational materials for use of such items.

Community Health (D)

Community Health refers to naturally occurring events that may cause morbidity and/or mortality to the Stanford community; these can include but are not limited to outbreaks of measles, TB, Q-fever, SARS, and Pandemic Flu. Although these are naturally occurring as opposed to a deliberate release, the preparedness and response need are very similar to Bioterrorism. The Biosafety program supports these needs by preparing and supplying educational information to the Stanford community. Additionally, the program helps to identify specific needs necessary to maintain the health, safety and functionality of the campus in case of an event.

Bio Laboratory (D)

The programs maintains a laboratory within EH&S with the capacity to handle BSL-2 agents safety. There is also the

ability to aid in preliminary identification of unknown materials. Space requirements: The Biosafety program provides expertise towards handling of materials potentially related to Bioterrorism. The program has an adjacent laboratory equipped with a Biosafety Cabinet, microscope and support materials for preliminary analysis of unknown materials. The Stanford University Department of Public Safety has relied on the Biosafety program a number of times for safe handling of unknown packages and materials. An appropriate laboratory space is required for this programmatic function.

Occupational Health (M)

Bloodborne Pathogens

Background

Regulatory Policy. “Bloodborne Pathogens” refers to pathogenic microorganisms that are present in human blood and can cause disease in humans and include semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any other body fluid that is visibly contaminated with blood such as saliva or vomitus, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids such as emergency response. These pathogens include, but are not limited to, hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV). The use of these materials is regulated by the 1992 Bloodborne Pathogens Standard (8 CCR 5193). The enforcement agency for this regulation is the California Occupational Health and Safety Administration, otherwise known as Cal/OSHA.

Exposure Control Plan

This plan is in compliance with the California OSHA Bloodborne Pathogens Standard (8 CCR • 5193) and provides tier III level training for personnel. The plan describes how to eliminate or minimize exposure of all Stanford University personnel to human/primate blood or blood products that might contain bloodborne pathogens. Each principle investigator (PI)/supervisor will complete an Exposure Plan based on the nature of the work being carried out in their facilities.



The PI/supervisor will indicate procedures and materials in the laboratory that have the possibility of exposing personnel to BBPs. Once completed, the plan will remain on file in a central location within the laboratory/work place. The Biosafety program produces and updates the plan as needed. The Stanford University Bloodborne Pathogen Program is designed to meet the requirements of the OSHA Bloodborne Pathogen Standard. On an annual basis, the Biosafety Manager is responsible for the content and will review the following program elements and documents: Initial Bloodborne Pathogen Training Program ([8 CCR 5193 \(g\)\(B\)\(2\)](#)); Update Annual Bloodborne Pathogen Training Program; The Exposure Control Plan ([8 CCR 5193 \(c\)](#)); and Post Exposure Follow Up Procedures ([8 CCR 5193 \(f\)](#)).

Sharps Program

Regulated by OSHA ([8 CCR 5193 \(D\)\(2\)](#)) and most recently revised in the *Needle Safety and Prevention Act* (2001) employers must keep a Sharps Injury Log for the recording of percutaneous injuries from contaminated sharps. Working with the Stanford University Occupational Health Center, the Biosafety program contacts all individuals upon notification of a Sharps injury to determine the cause of the incident and any preventative measures to be taken.

Exposures

Accidental exposures to potential hazardous biological materials or from animal bites and scratches are investigated by Biosafety personnel. Biosafety coordinates these investigations with the

SUOHC for any medical needs. Additionally, Biosafety communicates animal related incidents to the faculty and staff at the Research Animal Facility at Stanford, where appropriate follow up and training can be addressed.

Aerosol Transmissible Diseases (ATD)

Background

Regulatory Policy. Cal/OSHA standard ([8 CCR 5199](#)) regulates employee exposure to aerosol transmissible diseases (ATDs). The standard addresses both Aerosol Transmissible Diseases (ATDs) related to health care facilities and support services, and Aerosol Transmissible Pathogens specifically related to research laboratories (ATP-L). The enforcement agency for this regulation is the California Occupational Health and Safety Administration, otherwise known as Cal/OSHA.

Key Activities / Current Activities

The ATD requires the following sections as part of the standard: Aerosol Transmissible Diseases Exposure Control Plan ([8 CCR 5199\(d\)](#)); Engineering and Work Practice Controls and Personal Protective Equipment ([8 CCR 5199\(e\)](#)); Respiratory Protection ([8 CCR 5199\(g\)](#)); Medical Services ([8 CCR 5199\(h\)](#)); Training ([8 CCR 5199\(i\)](#)); and Recordkeeping ([8 CCR 5199\(j\)](#)).

The ATD Exposure Control Plan is currently being created and will be implemented when completed; note that the regulatory requirements call for separate plans for Clinical and Laboratory locations ([8 CCR 5199\(d\) and \(f\)](#)).

Future Needs / Challenge

Regulatory Trends

To help compliance with completion of the Bloodborne Pathogens Exposure Control Plan and elements associated with the Plan, Biosafety will explore the potential of using the Stanford on-line training system (STARS) as a platform for the Plan. Presently, communication and follow-up of Sharps exposures are performed in an ad-hoc manner by Biosafety and Stanford University Occupational Health Clinic personnel. To ensure maximum effectiveness, Biosafety and OHC have discussed the use of a surveillance program building upon current technology (STARS, Medgate) if possible. The ATD Exposure Control Plans (Clinical and Laboratory) and the required trainings must be completed and implemented.

Medical Waste Management

Overview

Purpose and Scope. The purpose of this Medical Waste Management Plan is to establish the overall plan regarding the handling of medical waste for Stanford University. The plan encompasses buildings on the campus of Stanford University and outlying buildings that are owned, operated and/or affiliated with Stanford University.

Authority and Responsibilities.

Authority: This Plan is required by the State of California Medical Waste Management Act, California Health and Safety Code Section 117710. **Department of Environmental Health and Safety:** It is the responsibility of EH&S to conduct and record quality control checks regarding the handling and disposal of untreated medical waste, tracking documents and other records applicable to the disposition of medical waste and maintain this Plan. EH&S provides Medical Waste Disposal Guidelines for generators of medical waste. **Principal Investigators, Department Managers and Supervisors:** PIs, Department managers and supervisors are responsible for ensuring the waste generated in the work area is segregated properly and collected in the appropriate container, the review of treatment records, equipment operations, and maintenance and repair logs. It is



STANFORD UNIVERSITY

also their responsibility to ensure safe handling of medical waste. **Employees:** Employees are responsible for following the guidelines established in this Plan. **Medical Waste Vendor:** The vendor is responsible for picking up, transporting and disposing of the medical waste from the designated pick-up sites in accordance with all applicable laws and regulations. The vendor supplies clean, re-usable rigid containers, lids, and liners for biohazardous waste. These containers and lids must meet the current California Biohazardous waste standards.

Procedures. Regulated Medical Waste is separated at the point of generation. If the medical waste is identified as containing hazardous chemical or radioactive materials it is subjected to the appropriate handling not as Medical Waste but in accordance with the applicable requirements.

Emergency Action Plan. Releases of small quantities which pose little to no safety or health threat, do not adversely affect the environment and are unlikely to grow in severity, do not require the involvement of the Stanford University HazMat Team and may be cleaned up by trained personnel with appropriate personal protective (PPE) and spill equipment. If the spill is considered too large or too dangerous for laboratory personnel to safely clean up, the area must immediately be evacuated and EH&S contacted for assistance.

Background

Regulatory Policy. The primary regulation regarding the disposal of medical waste is the 1990 Standard, Section 6.1 of the California Health and Safety Code known as the Medical Waste Management Act Section 117690. The enforcement agency for the California Medical Waste Management Act is Santa Clara County. The disposal of medical waste at Stanford University is department specific.

Key Activities / Current Activities

The Biosafety Manager is responsible for the following: draft guidelines for medical waste disposal and update as necessary; respond to medical waste related incidents, such as emergency recovery; selection of approved medical waste packaging process; routine audits for laboratory medical waste disposal; meet with Santa

Clara County medical waste inspectors as needed; and update the Stanford University Medical Waste Management Act Permit on an annual basis.

Future Needs / Challenges / Regulatory Trends

The School of Medicine is re-evaluating its present model of retaining a separate medical waste permit from the University. Upon completion of this review, the University Medical Waste Management Plan will be revised as necessary.

Shipping of Biological Dangerous Goods and Dry Ice

Background

Regulatory Policy. Federal and international agencies (ICAO, the branch of the United Nations that governs all international civil aviation matters), and IATA (International Air Transport Association) have in place numerous regulations for shipping of dangerous goods by surface or air. The United States Department of Transportation and the Federal Aviation Administration enforce strict and detailed regulations to assure the safety of aircraft and other modes of materials transportation of dangerous goods. By Federal law (49 CFR 172.704), shipping of dry ice, hazardous materials, or any other "Dangerous Goods" requires specific training and certification, and the material properly packaged and labeled. According to regulations, Biological Dangerous Goods "are articles or substances which are capable of posing a significant risk to health, safety or to property when transported". The person(s) packing the material and/or signing the shipping papers must be trained and certified in the shipping of dangerous goods. Training and certification for shipping dangerous goods must be repeated within every two year period to be valid.

Key Activities / Current Activities

Training to become certified can be done by completing the Biological Shipping Training Course--EHS-2700, DOT: Shipping Biological Goods or Dry Ice; this are available through the STARS system. To aid compliance with the regulatory requirements, EH&S has instituted a multi-faceted Quality Assurance (QA) program to review and evaluate campus regulatory compliance with DOT/IATA shipping requirements including the following

elements: Stanford's training and knowledge management documentation system, **STARS**, provides automatic notification to current certified shippers 30 days prior to certification expiring to minimize the possibility of lapse in shipping certification. Additionally the system includes the ability to contact all certified personnel who have taken the training with any update notices or changes in requirements. Additionally, EH&S, in conjunction with Stanford Procurement, has established an "authorization" program for **centralized departmental FedEx accounts** whereby personnel are not allowed to ship through FedEx unless they certify that they are not shipping Dangerous Goods or that they have completed the training and are appropriately certified.

Future Needs / Challenges / Regulatory Trends

Due to the ever changing regulations regarding shipping and input from multiple regulatory agencies, there is a constant need to re-evaluate the training program. Non-compliance with regulations can lead to citations and monetary fines from the FAA to individual Stanford University departments.

Biosafety Cabinet Certification

Background

Regulatory Policy. The use and maintenance of Class II biological safety cabinets is described in the guideline, the National Sanitation Foundation International Standard 49 (NSF STANDARD 49). In 1994, the State of California released a laboratory hood standard that regulated the use and maintenance of biological safety cabinets, known as Title 8, CCR, Section 5154.2, Ventilation Requirements For Biosafety Cabinets. In 1995, the Centers for Disease Control and Prevention (CDC) and the National Institutes of Health (NIH) published a guideline, Primary Containment for Biohazards: Selection, Installation and Use of Biological Safety Cabinets that also provided information on the proper use and selection of biosafety cabinets. The enforcement agency for proper biosafety cabinet usage regulation will primarily be the California Occupational Health and Safety Administration, otherwise known as Cal OSHA.



Key Activities / Current Activities

Maintenance of Biosafety Cabinet Inventory and Annual Certification: The location of all biosafety cabinets at Stanford University is maintained by a company contracted for Biosafety cabinet certification; the Biosafety Program has access to the database as needed. Currently there are more than 600 Biosafety cabinets that need to be certified annually. Biosafety personnel receive quarterly reports from the contracted company to ensure annual certifications are done in a timely manner. Issues encountered by the laboratory and/or contracted company during the maintenance of the Biosafety cabinets are overseen and resolved by Biosafety.

Biosafety Cabinet Purchase Review: All Class II biohazard cabinetry that is purchased at Stanford should be reviewed and approved by the Biosafety Manager prior to purchase. The purpose of this review is to ensure that the selected biosafety cabinet will be appropriate for the biohazardous material used and that the user is familiar with good work practice and maintenance of the biosafety cabinet.

Biosafety Cabinet Certification Contract Oversight: The Biosafety Manager will monitor the activity of the campus biosafety cabinet certification vendor in the following manner: audit the work performed on a periodic basis; Quarterly reports are required from the contract company; prepare specifications to select the vendor; and consult with user to ensure that the work is performed at the convenience and benefit of the user.

Biosafety Cabinet Use: The Biosafety program has made a number of use materials available to the Stanford community. Included are web-based videos showing the functions of a Biosafety Cabinet and corresponding proper use of the cabinet. Documents providing use and care of cabinets are also available.

Stanford University has taken a strong stance against the use of gas burners or alcohol flames in Biosafety cabinets. The decision has been made in accordance with recommendations from numerous agencies. The Centers for Disease Control

and Prevention (CDC) reports that “open flames are not required in the near microbe-free environment of a biological safety cabinet” and create “turbulence which disrupts the pattern of air supplied to the work surface” jeopardizing the sterility of the work area (BMBL5 page 14). This is also the recommendation of the World Health Organization (WHO) as well as the major Biosafety cabinet manufacturers. The Biosafety Program continues to face challenges from users concerning the use of open gas burners within Biosafety cabinets, a practice that the University has discouraged for a number of years. Additionally it has been observed that users often do not utilize an approved method for liquid waste generation, leading to potential contaminants in the vacuum system. Biosafety personnel address these issues during the APB Biovisits of laboratories. Researchers are informed of alternate sterilizing techniques and the required vacuum flask system that provides protection to the central building vacuum system or vacuum pump and to personnel who service the equipment

Future Needs / Challenges / Regulatory Trends

Biosafety Cabinets Gas Decontamination and Laboratory Moves

Biosafety cabinet gas decontamination prior to a laboratory move or relocation has been shown to be an area of concern. Cabinets will be moved without prior decontamination and/or not re-certified after the move. Biosafety personnel, with the help of SOM Health and Safety program will reemphasize to the Stanford research community and project planners the requirements for moving a BSC.

Ultraviolet Lights and Germicidal Activity

The Center for Disease Control (CDC) and the National Institute of Health agree that Ultraviolet (UV) lamps are not recommended nor required in BSCs ([BMBL](#), Appendix A, p. 306). Numerous factors affect the activity of the germicidal effect of UV light, which requires regular cleaning, maintenance and monitoring to ensure the germicidal effect. UV lamps must be turned off when the room is occupied to protect eyes and skin from UV exposure, which can burn the cornea and cause skin cancer. Proper use and cleaning of BSCs negates any need for the use of UV lamps. There is a potential for exposure to UV radiation above

recommended limits if working in or near a BSC with a UV light in use. In addition, the germicidal activity of UV lights is limited by a number of factors, many of which are difficult to control.

Though CDC and NIH are not recommending the usage of UV lamps in BSC laboratories are still using it in deactivating their BSC or tissue culture room. Biosafety personnel, with the help of EH&S will reemphasize to the Stanford research community and project planners the requirements for moving a BSC.

Biosafety Laboratory Plans Review

Background

Regulatory Policy. There currently is no regulatory standard regarding the design and construction of biological laboratories. The *NIH Guidelines* ([Appendix G, Section G-II-B-4](#)) states facility requirements. The only standard that may be applicable is the OSHA Bloodborne Pathogen Standard, Title 8, CCR Section 5193, Bloodborne Pathogens. All laboratories that involve HIV and HBV production must comply with the facility requirements of the OSHA Bloodborne Pathogen Standard which are roughly equivalent to Biosafety Level 3 as described in the [BMBL](#). The National Fire Protection Association (NFPA) has a guideline for the construction of general laboratories, NFPA 45. The Office of Statewide Health Planning and Development (OSHPD) has a guideline for health care facility renovation, Title 24, part 1, OSHPD Administrative Regulations for School of Medicine and Stanford Medical Clinics related renovation. The [BMBL](#) defines the principle of biological containment in laboratories.

Key Activities / Current Activities

The Biosafety Manager reviews architectural and engineering blue prints at the conceptual phase until completion of all laboratory renovations. The Biosafety Manager, at a minimum, checks for the following engineering features and procedural policies: availability of hand washing facilities; availability of emergency eyewash and shower; availability of biosafety cabinets; location of storage facilities and transport procedures; availability of autoclave facilities; availability of a fume hood to work with chemicals and radioactive materials as an adjunct to the biological research; APB application and experimental protocol of work; availability of personal protective equipment for



STANFORD UNIVERSITY

employees; training of employees; and biohazardous waste disposal.

Biosafety Personnel are additionally available to provide advice to Principal Investigators, Laboratory Managers or Building Managers regarding: Requirements in converting BSL1 to BSL2 research laboratory; Locating the new Biosafety cabinets in relation to lab access/ exits and research; Distance of eye wash and emergency shower to the new laboratory design; Proper ventilation needed for new projects or biological agent(s); and Designated Biological Waste location.

Future Needs / Challenges

Regulatory Trends

The Stanford University Laboratory Design Guide is a resource document for use by faculty, staff, and design professionals during the planning and early design phases of a project. This guide will be updated as new guidelines and regulations appear.

Biosafety Training

Background

Regulatory Policy. Biosafety training is mandated by the following regulations: Injury and Illness Prevention Program ([8 CCR 3203](#)), Bloodborne Pathogens ([8 CCR 5199](#)), Aerosol Transmissible Diseases standard ([8 CCR 5199](#)), Department of Transportation FAA

([49 CFR 171-180](#)), and OBA – [NIH Guidelines](#).

Key Activities / Current Activities

IIPP, Bloodborne Pathogens and FAA training have been developed and are available as web-based modules. Training for Aerosol Transmissible Diseases remains to be developed, although its content is addressed by APB review. NIH rDNA Guideline related trainings have been addressed through the development of the following on-line materials and in-person sessions: *Good laboratory practices*; *Viral Based Gene Vectors* (describes biosafety levels for a variety of commonly used viral vectors with different families of transgene inserts and envelope genes); *Working with Viral Vectors* (practical information on the nature of the viral vector, associated risks, and necessary precautions); *Biosafety Level Work Practice Requirements*; *ABSL-2 Training* (a combination of on-line material with in-person project specific training, done in coordination with the Research Animal Facility); and *Specialized Tier III training for Infectious Agents* (the program supplies training for personnel working with biological agents that are either new to the laboratory or have unfamiliar risks associated with them. Included in this category are agents that might have specific medical needs associated with them, i.e. vaccination, increased risk due to specific medical conditions, etc. The program often works in conjunction with the Occupational Medical Physician on

these issues. Training is done in person by the biosafety program).

Future Needs / Challenges / Regulatory Trends

General Laboratory Biosafety training, available as a web-based course for Stanford personnel, is currently undergoing a review for content and style. It is anticipated that the updated version will be available during 2012. Animal Biosafety Training - To help compliance and increase efficiency with completion of ABSL-2 training, Biosafety will explore the potential of using the Stanford on-line training system (STARS) as a platform for the specialized sections (viral vectors, bacterial agents, and viral agents) of animal biosafety training. This training module would need to be developed and Biosafety would work with the VSC to create this new training

Space Requirements (D)

The Biosafety program provides expertise towards handling of materials potentially related to Bioterrorism. The program has an adjacent laboratory equipped with a Biosafety Cabinet, microscope and support materials for preliminary analysis of unknown materials. The Stanford University Department of Public Safety has relied on the Biosafety program a number of times for safe handling of unknown packages and materials. An appropriate laboratory space is required for this programmatic function.

Ergonomics

Purpose	Educate employees, Prevent repetitive motion injuries ; Enable purchase of ergonomically-sound products; Establish cost-sharing incentives ; Support the SLAC ; Promote ergonomic risk reduction ; and Assist with campus moves .
Program Elements	Training Ergonomics Workstation Evaluations Ergonomic Equipment Recommendations Ergonomic Equipment Reimbursement Fund Program Management Contracted Services for SLAC Ergonomic Risk Reduction Campus Moves Future Needs / Challenges
Business Drivers	<ul style="list-style-type: none"> Workers Compensation Claims (Repetitive Motion) Equipment reimbursement fund program SLAC contracted services

Background

Ergonomics is the field of study that involves the application of knowledge about physiological, psychological and biomechanical stressors and limitations of the human body to such stressors. Knowledge gained from ergonomic review is applied in the planning, design, and

evaluation of work environments, jobs, tools and equipment to enhance worker performance, safety, and health. Ergonomics is essentially fitting the workplace to the worker while preventing exposures to known risk factors such as repetitive movements, awkward or static postures, contact stress, and excessive

force (all of which can potentially cause a work-related musculoskeletal disorder). In compliance with Cal/OSHA Standard (8 CCR 5110), the SU EH&S Ergonomics Program is established to assist departments minimize their risks of employee injury due to routine computer use, manual handling activities, and other

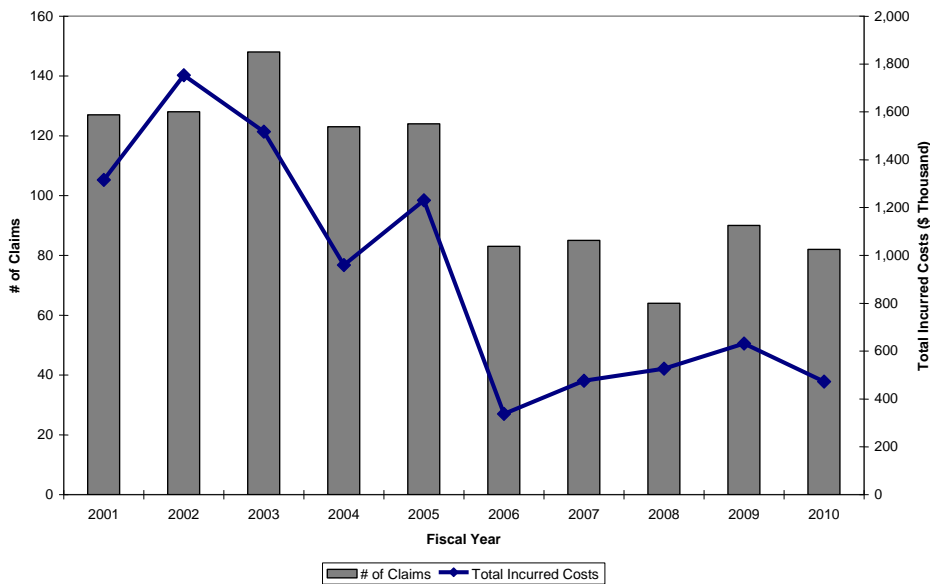


Figure 2
Repetitive Motion Workers Compensation Claims
FY 2001-2010

repetitive activities. From 2005-2010, over 400 Stanford University employees reported repetitive motion injuries (RMIs), totaling over \$2.4 million in lost time and medical costs, not counting the significant indirect costs such as lost work productivity and staffing replacement. As a result of an ongoing campus-wide ergonomics awareness campaign over the last ten years, recruitment of a full-time ergonomics specialist in 2006, and workers' compensation regulatory reform in 2004, repetitive motion injury rates and severities have begun to recede (refer to Figure 2).

Program Elements

Training

EHS makes available Cal/OSHA-required (8 CCR 5110(b)(3)) ergonomic awareness training for all Stanford employees who perform activities such as computer use, manual handling tasks, and repetitive laboratory work. Training is provided on-line and classroom-based sessions. Annually, approximately 1200 employees completed on-line computer ergonomics training (note: this training provides a workstation self-assessment tool for employees to evaluate their workstations for potential deficiencies). Annually, OHS provides approximately 25 live ergonomics classes for computer ergonomics, safe

lifting and manual handling, and laboratory ergonomics.

Ergonomic Workstation Evaluations

As required by Cal/OSHA 8 CCR 5110(b)(1), which mandates worksite evaluations for jobs with exposures that have caused repetitive motion injuries, EH&S provides ergonomic evaluation support for employees needing consult with computer use, laboratory activities, and various manual handling operations at all SU work areas. Evaluations consist of an analysis of applicable, research-based ergonomic risk factors in the employee's work activities, work environment, and work practices. Examples of common risk factors include: High-frequency movements; Long-duration, static work positions; Awkward postures; Contact stress against soft tissues; Insufficient rest breaks away from work activities. Ergonomic job analysis may require extensive research to determine possible solutions in reducing ergonomic risk for unique work operations. Reference to biomechanical analysis tools, ergonomics research, occupational health providers, and other subject matter experts helps ensure a comprehensive review of ergonomic risk. Following each evaluation, EH&S provides recommendations for corrective actions to

address identified ergonomic risks. As required by 8 CCR 5110b(2), recommendations are to be implemented by the supervisor in a timely fashion.

Ergonomic Equipment Recommendations

Equipment Review / Selection

To assist supervisors with maintaining their Cal/OSHA 8 CCR 5110 responsibility of promptly correcting identified ergonomic-related deficiencies, EH&S established a pre-approved list of ergonomic equipment/ furniture to help ensure that departments purchase ergonomically-sound products. In maintaining this product list, the Ergonomics Program: 1) Identifies and selects products by researching evidence-based guidelines and ergonomics best practices; 2) Coordinates with product manufacturers and vendors to secure demo products for the Ergonomics Showroom (described below); and 3) Works with Stanford's Procurement Department to facilitate ordering of approved products using the the Smart Mart system. For specialized products, the Ergonomics Program identifies vendors that provide solutions that can be obtained quickly while making the most efficient use of University resources.

Showroom

EH&S-approved computer workstation products can be "test-driven" at the Ergonomics Showroom, an on-campus lab maintained by the Ergonomics Program that showcases chairs and other ergonomic apparatus and equipment. The primary benefits include: 1) EH&S has further opportunity to promote the University's proactive efforts with ergonomics training and self-assessment; 2) Elimination of personnel exposure to misinformation from retail salespersons; and 3) Personnel ability to better select equipment without the inconvenience of driving to off-campus stores or showrooms. Annually, over 290 employees visit the Ergonomics Showroom for equipment consultation. To allow multiple visitors, make the most efficient use of resources, and allow for all of the equipment, a space of 200 ft² is required.



Ergonomic Equipment Reimbursement Fund Program

With annual funding support from Risk Management, the Ergonomics Program administers the Ergonomic Equipment Reimbursement Fund Program which provides a cost-sharing incentive for ergonomic workstation and work-process improvements where employees have fulfilled their ergonomic training and self-evaluation requirements. EH&S administers the partial reimbursement system by providing guidance on pre-approved products (as described above) and processing applications for funding support, which includes review of training records, workstation assessments, and purchase invoices. Annually, more than 200 employees participate in the Reimbursement Fund Program, effectively distributing over \$19,000 of available funds.

Contracted Services for SLAC

As part of an OHS contract to provide occupational medical services at SLAC, OHS assists the SLAC Ergonomics Program with maintaining their Fed/OSHA 29 USC 654 “general duty” responsibilities by providing ergonomics services congruent to what is required by Cal/OSHA 8 CCR 5110 for SLAC employees and eligible affiliates. One FTE of EH&S support services are provided which consist of a field ergonomist and senior-level oversight to help develop and maintain a site ergonomics program. Primary activities include ergonomic assessments and training and establishing an on-site Ergonomics Showroom at the SLAC campus (as described above) as well as providing consultation to the SLAC Ergonomics Program management. Because of SLAC’s DOE oversight, additional review and coordination may be needed to ensure compliance with DOE policies.

Ergonomic Risk Reduction

In the past several years, the Ergonomics Program has focused on several efforts to

increase workplace ergonomics awareness of the general University population as well as for specific departments identified as having elevated injury risk.

Campus-Wide

In compliance with the communication component of the IIPP standard (Cal/OSHA 8 CCR 3203), the Ergonomics Program has sought new avenues to raise ergonomic awareness among the University employee and student populations.

BeWell Collaboration: OHS has partnered with the SU BeWell Program to increase the reach of workplace health and safety programs and services, including the following: Participation at the SU Wellness Fair, Inclusion of ergonomics training as BeWell Program “Berries”, and Collaboration with the Health Improvement Program for ancillary classes/resources to improve workplace health. *Campus Events:* The Ergonomics Program currently participates in the following annual events: ITS Open House, Staples Product Fair, and Blood Center Safety Day.

Department-Specific

Upon request and where specific areas of higher risk are identified, the Ergonomics Program assists department supervisors in focusing proactive efforts with targeted employee groups (per the Cal/OSHA ergonomics requirement [8 CCR 5110] and IIPP requirement [8 CCR 3203]). These risk intervention services typically involve: 1) ergonomic evaluation of high risk processes; 2) staff ergonomics training; and 3) consultation on workplace/ process modification(s). For example, the Ergonomics Program facilitated interventions with the ITS Department, SU Grounds, and Student Housing. Interventions consist of: Ergonomic risk assessment and evaluation, •Discussions with stakeholders on feasible work practices and equipment to reduce ergonomic risk, Ergonomics training, and Corrective action implementation where needed.

Campus Moves

The Ergonomics Program assists departments moving to new facilities by providing guidance on ergonomic furniture and equipment, promulgating materials for

employee self-assessment of new workstations, and conducting on-site ergonomic consultations for staff requiring additional assistance. Such efforts require extensive process review with department and project management and may require extensive travel to new worksites. During the past several years, the program has assisted with large department moves for Business Affairs, the School of Medicine, and the School of Engineering.

Future Needs / Challenges

To make further impacts on musculoskeletal injury risk reduction, the Ergonomics Program continues the following efforts:

- Work locally with at-risk departments to assess work activities and environments.
- Coordinate move services for staff migrations as the University continues the push to move administrative staff away from the Main Campus.
- As new injury prevention materials are produced, the program will explore local EH&S and other campus resources as forums to promote ergonomic health.

Resources including but not limited to staff ergonomics specialists, the Ergonomics Showroom, the Equipment Reimbursement Fund, department service vehicles, and training facilities will be critical in delivering overall University injury risk reduction.

As SLAC continues to develop its ergonomics program, OHS will closely coordinate with SLAC management and the SU Occupational Health Center to determine future service needs and further assist with workplace injury case management.

Facility Requirements. For continuing/future Ergonomics Program efforts, ample facilities will be required for the following: Live ergonomics training (a training facility should accommodate at least 36 people); and Ergonomic Products Showroom (as discussed above, 200 ft² is sufficient to house equipment and allow multiple visitors).



Facilities

Construction, Renovation, Maintenance, and Decommissioning

Purpose	Prevent asbestos and lead poisoning; Remediate legacy construction contaminated with asbestos and lead; Evaluate safety of planned or existing playgrounds.
Program Elements	Asbestos Management Lead Management Facilities Decommissioning and Closure Playground Safety Construction Safety
Business Drivers	<ul style="list-style-type: none"> • Regulations and Litigation • New Facility Construction or Remodeling • Existing Facility Decommissioning or Closures

The Asbestos, Lead and Construction Safety Program is responsible for assessing and managing the remediation of hazardous materials impacted by construction, renovation and facility maintenance activities. Included are previously installed hazardous construction products such as asbestos and lead paint as well as building components or equipment that have been potentially contaminated by exposure to chemical, biohazardous or radioactive material use. The Program also provides safety evaluations of planned or existing public playgrounds.

Asbestos Management

Background

Asbestos is one of the most highly regulated and litigated hazardous materials in the U.S. due to its carcinogenic affects and widespread use in construction materials. The Asbestos, Lead and Construction Safety Program provides a comprehensive range of services related to any activity that may impact asbestos on campus.

Federal laws and regulations: Occupational Safety and Health Act, 29 USC 651 et seq., and all applicable Occupational Safety and Health Administration (OSHA) regulations there under; Clean Air Act, 42 USC 7401 et seq., and all applicable U.S. Environmental Protection Agency (EPA) regulations there under; Hazardous Materials Transportation Act, 49 USC 1801 et seq., and all applicable Department of Transportation (DOT) regulations there under.

State of California laws and regulations: Hazardous Substances Information and Training Act, Labor Code 6360 et seq.;

Labor Code 6401.7, 6408, 6501.5 through 6501.9, 6503.5, 6505.5, 9021.5, 9030; all applicable regulations of the Department of Industrial Relations (DIR) including 8 CCR 340 through 342, 1531, 1509, 3202, 5144, 5156 through 5158, 5194, 5208 and 1529; Hazardous Waste Control Law, Health and Safety Code 25100 et seq., and all applicable Department of Toxic Substances Control (DTSC) regulations there under, including 22 CCR Div. 4.5 et seq.; Safe Drinking Water and Toxic Enforcement Act of 1986, Health & Safety Code 25249.5 et seq., and all applicable regulations there under, including 22 CCR 12100 et seq.; Bus. & Prof. Code 7058.5 and corresponding regulations, including 16 CCR Ch. 8.

Local laws and regulations: Bay Area Air Quality Management District (BAAQMD), Regulation 11, Rule 2.

Program Elements

Written Program

The Asbestos, Lead and Construction Safety Program has developed a comprehensive written Asbestos Management Plan (AMP) document that defines responsibilities and methods used by the university to fulfill compliance obligations and protect employees, students, contractors and visitors from exposure to asbestos hazards.

Litigation

The Asbestos, Lead and Construction Safety Program Manager works closely with the General Counsel’s Office and the outside law firm of Barg, Coffin, Lewis and Trapp, LLP on asbestos-related lawsuits. As defendant for premise-based lawsuits brought by contractor employees claiming exposure on past construction or renovation projects, the Program provides

records review and analysis of historic data, sworn depositions and expert testimony. As plaintiff, Stanford has joined and received settlements from class action lawsuits filed against asbestos manufacturers for harm caused by the installation of their products in campus facilities. The Asbestos, Lead and Construction Safety Program reviews, collects and organizes data related to the location, quantity and abatement cost of ACMs and provides sworn affidavits for court filings.

Responsibilities

The development, administration, coordination and management of the Program is the responsibility of the Asbestos, Lead and Construction Safety Program Manager with elements of the program implemented as described below.



Role	Responsibilities
EH&S Asbestos Program	Represent the University on matters of regulatory compliance and act as liaison to agencies having jurisdiction over asbestos-related issues; ensure asbestos-related activities are conducted in compliance with applicable laws and regulations; Inspect, identify and inventory accessible asbestos-containing material (ACM) and presumed asbestos-containing material (PACM) in Stanford owned and leased buildings; provide periodic inspections to ensure that identified materials are maintained in a non-hazardous condition; Provide detailed building material surveys of areas scheduled for demolition or renovation; coordinate abatement of affected ACMs prior to, or phased with, other construction activities; Provide employee exposure and work practice evaluation to ensure protective measures are adequate and conform to regulatory requirements; Conduct training needs assessment for employees and ensure that required training is developed and delivered; Provide notifications and install warning signs and labels as required by applicable laws and regulations; Develop and provide abatement project specifications and oversight of abatement activities; provide recommended procedures to Schools and Departments; provide consultation to project and construction managers; Develop and maintain qualification standards for asbestos abatement contractors and consultants; evaluate contractors and consultants based on the qualification criteria; maintain a list of contractors and consultants approved to work at the University; Respond to asbestos-related concerns and inquiries raised by the campus community; provide consultation and maintain technical expertise on asbestos-related issues; and Provide centralized data management and maintenance of asbestos-related records.
Stanford University Fire Marshal	Ensure that a comment mandating asbestos assessment and clearance by EH&S is included in all construction project plan reviews.
Schools and Departments	Maintain familiarity with, and implement applicable elements of, the AMP; provide resources to implement program requirements; ensure staff receive required or recommended training; Ensure that individuals within the School or Department responsible for management of construction projects are aware of asbestos program requirements; and Notify EH&S of any visible damage or deterioration to known or suspect ACM in a timely fashion.
Supervisors	Ensure new employees are provided access to the current (Connelly Act) asbestos notification letter within two weeks of start date and are aware of building material disturbance restrictions; Coordinate and schedule required training and medical surveillance and provide personal protective equipment (if applicable) for employees; maintain employee records in an organized fashion; and Ensure employees are aware of, and comply with, asbestos-related protocols and procedures.
Employees	Attend required training; Use protective equipment properly and follow asbestos-related protocols and procedures; and Notify EH&S or supervisor of any visible damage or deterioration to known or suspect ACM in a timely fashion.

Oversight of Contractors and Consultants

Pre-Qualification Requirements

The Asbestos, Lead and Construction Safety Program Manager maintains a list of qualified asbestos abatement contractors and consultants approved to work at Stanford. Companies must submit the following information and documentation for review and approval prior to bidding on work and/or award of contract. Contractors must submit: Company profile, resumes of management personnel, description of at least three representative projects with references, description of company's Injury and Illness Prevention Program, DOSH registration and the certification issued by the State of California Contractors License Board, asbestos liability insurance certificate and a list of citations or penalties, past or pending, issued by any regulatory agency. Consultants must submit: Company profile, resumes of management personnel, description of at least three representative projects with references, description of company's Injury

and Prevention Program and a detailed description of QA/QC protocols and procedures used to minimize random and systematic errors associated with equipment use, survey and sampling methodologies, data validation and report generation

Abatement Project Specifications

Stanford has developed a uniform asbestos abatement project specification that governs all aspects of contracted asbestos-related work, including work performed under master service order agreements. The specification is provided to construction project managers and is periodically reviewed by the Asbestos, Lead and Construction Safety Program Manager to ensure regulatory compliance elements remain current.

Uniform Reporting

Stanford has developed a series of uniform recordkeeping and reporting forms to document contractor compliance with asbestos safety requirements. The forms

are used by in-house personnel and issued to outside asbestos consultants hired to perform oversight of asbestos abatement projects. The forms are reviewed by the Asbestos, Lead and Construction Safety Program Manager periodically to ensure compliance elements remain current and consistent with the abatement specification.

Master Service Order Agreements

Stanford maintains Master Service Order Agreements with asbestos abatement contractors and asbestos consultants. The master agreements ensure a quick response in the event of an asbestos release and provide an effective means to manage small-scale projects. The Asbestos, Lead and Construction Safety Program Manager determines the number of agreements necessary to provide coverage of Stanford projects and coordinates development and award of the agreements with Stanford's Contracts and Procurement Office.



Building Inspections and Hazard Assessment

Initial Inspections

The Asbestos, Lead and Construction Safety Program reviews archive building survey and abatement information and performs building inspections to identify known and presumed ACMs. A summary of this asbestos inventory data is provided on-line to students, faculty and staff and is updated when new survey or abatement information becomes available. To date, Stanford has conducted numerous inspections and building materials surveys.

Periodic Inspections

Following initial inspection, buildings found to contain ACM or PACM may be re-inspected on a periodic basis to ensure identified materials remain in a non-hazardous condition. Buildings identified with OSHA Class I (friable) ACMs are prioritized for periodic re-inspections.

Construction Project-Related surveys

A comprehensive asbestos survey, which may include bulk material sampling and destructive methods to access hidden materials, is required prior to the start of any renovation or demolition project. The construction project manager is responsible for requesting the survey and providing any descriptions, plans, drawings or specifications that identify the extent of the work. A written report that details the findings of the survey and provides an inventory and location of confirmed ACMs within the project area is generated and provided to the construction project manager.

Hazard Assessment

During the course of an asbestos inspection or survey the inspector assesses the physical condition of the ACM and determines if a potential airborne hazard may exist. If, based on this assessment, a response action is deemed necessary the inspector initiates such action and provides oversight until the abatement operation has been completed.

Inspection Data Management

The Asbestos, Lead and Construction Safety Program Manager maintains building inspection and survey information in a manner which is organized, accessible and readily available. This includes, but is not limited to, hard copies of raw data and reports as well as electronic data.

Notifications

Contractor Notifications

General contractors engaged in construction related activities are notified of the presence and location of known asbestos-containing materials within their defined project areas. The Asbestos, Lead and Construction Safety Program Manager provides such information to the Stanford construction project manager and/or contracts office to be incorporated into contact documents. Contractors are instructed to stop work and notify the project manager immediately if additional (hidden) asbestos-containing materials are discovered during the course of their work.

Abatement-related notifications

Prior to the start of an asbestos removal project, the abatement contractor is required to provide notification to the appropriate regulatory agencies. Notifications may include, but are not limited to, the Cal/OSHA temporary worksite notification and the Bay Area Air Quality Management District's NESHAPs notification. The abatement contractor is required to post OSHA asbestos regulated area warning signs at the entrance to any abatement area as mandated by OSHA regulations. The Stanford construction project manager is required to notify tenants who occupy building areas adjacent to an asbestos abatement activity of the nature and duration of the work. Notification can be in the form of written or verbal communication or in the posting of signs. The Asbestos, Lead and Construction Safety Program assists the construction project manager in developing postings of this nature.

Signs and Labels

Cal/OSHA regulations require building owners to post asbestos warning signs at the entrances to mechanical rooms that contain asbestos thermal system insulation (TSI) or surfacing materials. The regulation also requires labeling, where feasible, of existing installed asbestos-containing products. As part of the building inspection process the inspector:

- 1) determines which areas require posting;
- 2) generates signs which conform to the regulatory requirements;
- 3) posts the signs;
- 4) logs and tracks the locations of the signs in the program's electronic recordkeeping system. Where feasible, warning labels are

installed on confirmed asbestos-containing products.

Connelly Act Notification

State regulations (Connelly Bill, AB 3713) require building owners to provide written notification to employees and contractors regarding known asbestos-containing construction materials within their buildings. Notification must be provided to new employees within two weeks of employment start date and to all employees on an annual basis. The notification letter is available on-line and employees are directed to the letter annually via a post card mailing.

Response Actions

Incidental Release

Incidental release of asbestos-containing materials may occur during an inadvertent disturbance or unforeseen environmental condition. Examples of these types of releases include: 1) a carpenter opening a wall cavity and damaging an asbestos insulated pipe riser; and 2) a water leak that causes asbestos ceiling plaster to delaminate and fall. If the release occurs during off-hours, the Asbestos, Lead and Construction Safety Program Manager determines if immediate abatement action is required or if the affected area can be isolated for a delayed response during normal business hours. The Asbestos, Lead and Construction Safety Program Manager provides a hazard assessment and determines the appropriate response action to an incidental release. Contributing factors influencing the level of response action include, but are not limited to; material friability, quantity released, moisture content, percent concentration of asbestos, area ventilation, level of occupancy and type of occupancy (use of space). The Asbestos, Lead and Construction Safety Program Manager coordinates evacuation and isolation of the area with facility managers (if necessary) and abatement of the hazard. The Asbestos, Lead and Construction Safety Program Manager also determines, by environmental air monitoring or other means, when it is safe to re-enter the isolated area.

Emergency Preparedness

In the event of a major earthquake significant quantities of asbestos-containing materials may become dislodged or damaged and release airborne



STANFORD UNIVERSITY

fibers. This condition may render an area or entire building unsafe to enter and hamper efforts by entities in charge of initial assessment and response activities such as structural engineers and Facility Operations personnel. The Asbestos, Lead and Construction Safety Program Manager maintains a list of buildings with the highest potential for airborne asbestos fiber release during a major earthquake. Generally, the highest priority buildings on this list contain significant quantities of soft, friable surfacing materials, such as spray-applied structural fireproofing and acoustic ceiling plaster, and areas with large quantities of thermal system insulation such as boiler rooms. The list is updated on a periodic basis to reflect ongoing abatement activities and provided to campus entities responsible for emergency preparedness planning and coordination of response actions. The Asbestos Management Program assists the initial response team by providing inspections, air monitoring and asbestos hazard assessments that can be used to determine if a building or area is safe to reenter or reoccupy. The Asbestos, Lead and Construction Safety Program Manager also coordinates response actions to abate identified asbestos hazards.

Air Monitoring

Environmental Monitoring

Environmental air monitoring is used to evaluate airborne fiber concentrations within a prescribed building area or to release an area for re-occupancy following completion of an abatement activity. An Asbestos, Lead and Construction Safety Program inspector determines, based on a hazard assessment, if ambient airborne fiber monitoring is necessary and, if so, which sample collection and analysis method is appropriate. The inspector also evaluates sampling results to determine if airborne fiber levels comply with established regulatory requirements and, if not, designates the appropriate response action to abate elevated airborne fiber levels. The need for environmental “clearance” monitoring following an abatement activity is dependent on the nature of the activity, type and quantity of asbestos-containing material affected, engineering controls used and area occupancy. Protocols for clearance monitoring of large-scale abatement projects are defined in the University’s uniform asbestos abatement specification.

The inspector evaluated if environmental monitoring is required and which sampling and analysis methods are appropriate based on the aforementioned conditions.

Personnel Exposure Monitoring

Personal exposure monitoring is used to evaluate an employee’s exposure to airborne fibers during an asbestos-related activity and to determine if the level of respiratory protection worn by the employee is adequate to prevent over-exposure. Initial and periodic monitoring of employees engaged in asbestos-related work is conducted per Cal/OSHA requirements. Separate monitoring is provided for each distinct work task. The inspector determines, based on the results of initial monitoring and regulatory requirements, if additional periodic monitoring is required and, if so, the appropriate monitoring interval. Exposure monitoring data is entered into a database and a hardcopy report is generated for each monitoring episode. The report is provided to the employee and employee’s supervisor.

Training

Asbestos Awareness

Asbestos awareness training is recommended for all employees who may encounter, but do not disturb, asbestos-containing materials during the course of their work. Awareness training is developed and delivered by the Asbestos, Lead and Construction Safety Program and contains the following elements: asbestos uses and forms, health effects, location of asbestos within the facility, regulations, safe work practices and prohibited activities. Asbestos awareness training is mandatory for employees who perform housekeeping operations in areas where asbestos-containing materials are present. Awareness training is developed and delivered by the Asbestos, Lead and Construction Safety Program and contains the following elements: health effects, location of asbestos within the facility, recognition of damage and deterioration, regulatory requirements, and proper response to fiber release episodes. Training is required initially and at least annually thereafter.

Asbestos Abatement Skills

In addition to classroom asbestos awareness training, employees who disturb asbestos-containing materials through the

normal course of their work are required to undergo asbestos skills training. Skills training is specific and customized to the individual work task, such as removing small amounts of asbestos floor tile to augment a repair, and fulfills Cal/OSHA requirements for Class III Training. Such training is required initially and annually thereafter.

Awareness for Supervisors and Project Managers

EH&S has developed an asbestos awareness training for supervisors and construction project managers that provides information on Stanford’s policy and procedures related to ACMs.

Operations and Maintenance Procedures

The Program is responsible for developing or approving work procedures for each distinct asbestos-related task performed by university employees. Each work procedure is assigned a unique identification number and contains a header with the procedure title, application, brief description and last revision date. The body of the procedure is divided into three sections, which address personal protective equipment, materials and equipment required to perform the task, and the step-by-step procedure itself. In addition, and prior to the start of any new procedure, the Program provides oversight and hands-on skills training to the employee performing the asbestos-related task.xx

Recordkeeping

Asbestos Management Program

The Program maintains, in hardcopy and/or electronic format, the following records: building inspection and survey reports, asbestos abatement project documentation, environmental and personal exposure monitoring, operations and maintenance procedures, equipment calibration and maintenance information, sampling and analysis data, and all other documentation directly related to the Asbestos Management Program. Information and documentation related to a specific building or building area, such as inspection data and abatement records, is organized by Quad and Building Number.

Supervisors

Supervisors are responsible for maintaining the following asbestos-related



documentation applicable to employees under their supervision: asbestos training certificates, medical surveillance reports, respirator fit testing data, and asbestos work procedures.

Future Needs / Challenges

It would be beneficial for the university to establish a dedicated fund for the abatement of asbestos-containing materials (ACMs). Currently, funding for such activity is derived from construction project or Zone Management budgets and Project Managers in charge of these accounts are only required to remove ACMs that are directly impacted by their work. This “short-term” mode of operation neglects the long-term benefits of removing all ACMs within a project’s boundaries. Removal of ACM eliminates the need for on-going management of the material, eliminates the need for additional, and often more costly, abatement during future renovation or maintenance activities, eliminates the potential risk of exposure from disturbance of such material, and reduces the university’s overall asbestos liability risk.

Lead Management

Background

Due to its toxicity and widespread use in industrial coatings and pre-1978 residential paints lead is highly regulated through a variety of agencies on the federal, state and local levels. The Program oversees compliance obligations (8 CCR 1532.10) of the University.

Program Elements

Written Program

The Asbestos, Lead and Construction Safety Program has developed a comprehensive written Lead Management Plan document that defines responsibilities and methods used by the university to fulfill compliance obligations and protect employees, students, contractors and visitors from exposure to lead hazards.

Child Lead Poisoning Prevention

The Program provides consultation to Residential and Dining Enterprises (R&DE) on EPA Title X lead paint notification requirements and periodically reviews documentation developed by R&DE for compliance purposes. When

requested, the Program conducts lead-based paint surveys and risk assessments of family housing units and provides management and oversight of housing construction and maintenance activities that impact lead-based paint.

Worker Safety

The Program provides consultation to LBRE line management on OSHA worker protection requirements, provides lead awareness training to university employees and provides testing and hazard evaluation of suspect coatings.

Construction Management

The Program provides consultation to LBRE and department construction project managers on lead-related hazards, conducts lead-based paint surveys prior to planned renovation/demolition of structures and provides management and oversight of construction activities that impact lead-based paint.

Contracts Office

The Program provides consultation to the Contracts Office on lead-related contractor certifications and pollution liability insurance requirements.

Future Needs / Challenges

No changes are currently planned regarding EH&S lead-related policies and procedures.

Facilities

Decommissioning and Closure

Background

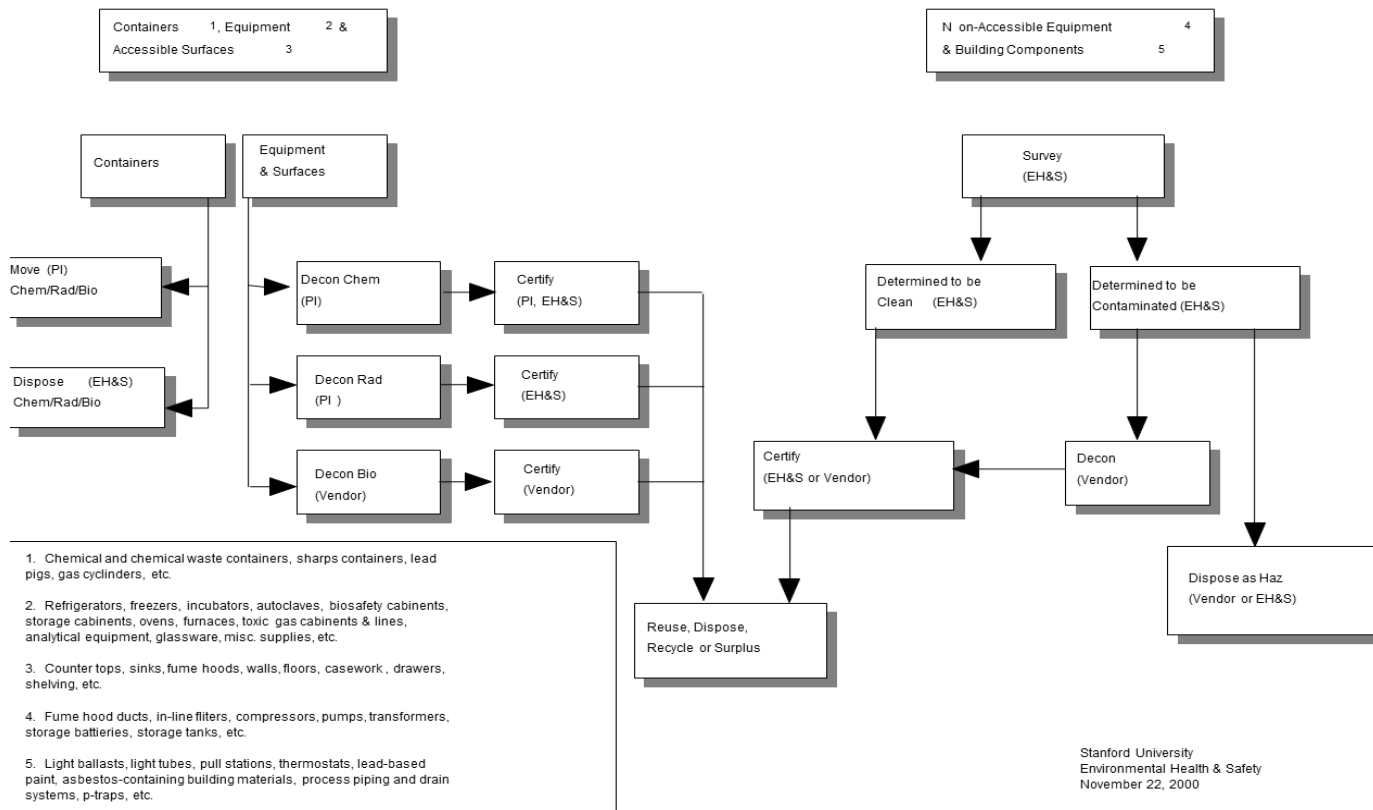
The terms “decommissioning” or “deactivation” refer to the process whereby an area or structure where hazardous materials were previously used or stored is certified to be free of such materials and any residual contamination caused by such use or storage has been cleaned to an acceptable level. The term “closure” refers to decommissioning that also involves modification or cancellation of a facility’s Hazardous Materials Use Permit or Hazardous Materials Registration. Depending on the physical location of the facility, permits and registration fall either under the jurisdiction of the City of Palo Alto (PAMC 17.32.010) or the County of Santa Clara (Section B11-308.01). Decommissioning is an internal university process that does not require regulatory

oversight and generally applies when an area within a building, such as a laboratory, is vacated. In this example, closure would not be required unless or until the area undergoes some type of modification or the building itself discontinues the use of all hazardous materials. Decommissioning without closure is unusual in that laboratory moves are generally prompted by planned renovation or demolition, in which case closure would always apply.



Responsibilities

Various groups within EH&S, as well as outside departments share responsibility for aspects of this process (refer to the flowchart)



Role	Responsibilities
Departments / Researchers	Move all equipment, glassware, supplies and any chemical, radioactive or biohazardous materials still in use to their new designated location; Tag all hazardous waste and submit a pick-up request to EH&S EPP; Request a terminal radiation survey (if applicable) from EH&S. EH&S will remove or deface all radiation warning signs and labels following successful completion of the terminal survey; Disinfect all surfaces, glassware, equipment, etc. associated with biohazardous materials. Remove or deface biohazard warning signs and labels following disinfections; Ensure all equipment, bench tops, shelving, storage cabinets, fume hoods, and other accessible surfaces are free of visible chemical residue. Clean (wipe down) surfaces/equipment as necessary and manage cleaning materials as hazardous waste (if applicable).
Project / Construction Managers	Request a hazardous materials building survey from EH&S prior to construction activity; Notify contractors of all hazardous materials or conditions present in their work area; Keep departments, researchers & EH&S apprised of construction schedule.
EH&S	Perform a survey to identify hazardous building materials, e.g., asbestos, PCB light ballasts, mercury pull stations, etc.; Submit Closure Application to the City or County and coordinate agency inspections; Inspect and evaluate accessible and non-accessible surfaces, such as fume hood duct interiors, for potential contamination; Coordinate abatement contractors and provide oversight of abatement operations.
General Contractors	Ensure all decommissioning work, closure and abatement (to be done by others) has been completed prior to the start of construction; Comply with the EH&S Hazardous Materials Procedures as specified in contract documents as well as all federal, state and local laws and regulations; Stop work and report any hidden hazardous conditions or materials to the Project Manager immediately upon discovery.

Process

In general, the steps that the Program follows for facility closure are: Review current chemical inventory for the area using the ChemTracker system. Generate inventory reports to be included in the Closure Plan, if required; Review area history to determine historic chemicals of

concern and identify potential areas of contamination; Review facility configuration and as-built drawings to determine if there are hazardous materials systems or hazardous materials-containing equipment that should be addressed during closure, e.g., tanks, piping, exhaust and treatment systems, etc.; Submit the

“Closure Application for Aboveground Hazardous Materials Storage Facilities”, Form UN-033, to the City or County agency having jurisdiction. Arrange for payment of permit fees, if required. Secure agency approval. Develop and implement a Closure Plan if requested. Coordinate compliance inspections and accompany



agency inspectors. Develop and submit a Post-Closure report to the agency, if required; Visually inspect to ensure that all chemical, radiological and biological materials have been removed or disposed, contaminated equipment is identified, and the condition of hazardous materials transport, treatment or storage systems are noted. Depending on the history or the schedule of activities, more than one visual inspection may be required; Conduct sampling if there is potential for disposed materials to be hazardous waste, or if identification of the concentration of contaminants is prudent to provide adequate worker protection; and Coordinate and provide oversight of remediation contractors hired to mitigate hazards previously identified.

Future Needs / Challenges

A significant portion of the process is the responsibility of the school or department. The decommissioning responsibilities of the PI are either not well conveyed by the department or not enforced. PIs leaving a lab are not inclined to be janitors and therefore the level of cleaning (decontamination) under their care can be inadequate. It is recommended that this responsibility be shifted away from the department and transferred to the construction project as a standard budget line item. This will add structure, limit construction delays, increase safety and ensure regulatory compliance.

Playground Safety

Background

The purpose of the Playground Safety Program is to decrease the occurrence of all types of injuries that a child might suffer while playing at any playground in the Stanford community, with a focus on prevention of fatal injuries. California Health & Safety (H&S) Code §115725 – 115735 became effective January 1, 2008. Under the regulations in effect from January 1, 2000 to January 1, 2008 (22 CCR 65700-65755), Stanford only needed to comply with parts of the CPSC Guidelines and ASTM standard. Now all new playgrounds (and repaired playgrounds) have to conform to all parts of both (updated) standards. The ASTM and CPSC conflict with each other on scores of technical details, which makes implementation of both standards

somewhat challenging. In the first few years of the Program, EH&S focused on initial inspections, comprehensive safety inspections, and repairs of non-compliant components in order to assist operators in complying with the regulations. For the most part, playgrounds across campus were brought into compliance with the original safety rules as of January 1, 2003. Some campus units, such as R&DE, chose to make minimal repairs to existing equipment, while others such as WorkLife, often replaced whole playground structures entirely.

Program Elements

Inspections

Inspections must be performed by a Certified Playground Safety Inspector using the tools and gauges proscribed by the CPSC Guidelines and ASTM standard. The initial inspections required in 2000 were performed by EH&S. In 2002, more comprehensive, written inspections were performed in order to identify and quantify all the deficiencies. The inspection reports are now being used by Residential & Dining Enterprises, Faculty Staff Housing, WorkLife, and LBRE to guide their compliance efforts. Currently, inspections of playgrounds are carried out by a Certified Playground Safety Inspector on an as-needed basis.

Plan Reviews

With the current surge of new construction on campus, the Program's focus has shifted from inspections of existing playgrounds to assisting project managers with the design of new playgrounds. In some cases, such as at the Arboretum and Madera childcare centers, an entirely new playground will be installed. In other cases, it may not be economically feasible to repair or modify existing equipment in order to bring it into compliance with Title 22 CCR Chapter 22. In these cases, play structures may be demolished and replaced altogether (Bing Nursery School) or the entire playground will be rebuilt (Olmsted Housing). The Certified Playground Safety Inspector at EH&S reviews the plans for the new playground before equipment is installed and certifies in writing that the newly installed equipment complies with Section 115725 requirements. Section 115725 begins with: "All new playgrounds open to the public built by a public agency or any other entity shall conform to the

playground-related standards set forth by the American Society for Testing and Materials and the playground-related guidelines set forth by the United States Consumer Product Safety Commission." The old regulations referenced only portions of one ASTM standard, F1487, but a strict interpretation of the new code means that all "playground-related" ASTM standards must be followed. The Code does not enumerate each ASTM standard that has to be followed, but at least seven "playground-related" standards are known to EH&S and applicable to most playgrounds: ASTM F1292 -09 Standard Specification for Impact Attenuation of Surfacing Materials within the Use Zone of Playground Equipment; ASTM F1487 -07ae1 Standard Consumer Safety Performance Specification for Playground Equipment for Public Use; ASTM F1951 -09b Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment; ASTM F2049 -10 Standard Guide for Fences/Barriers for Public, Commercial, and Multi-Family Residential Use Outdoor Play Areas; ASTM F2075 -10a Standard Specification for Engineered Wood Fiber for Use as a Playground Safety Surface Under and Around Playground Equipment; ASTM F2375 -09 Standard Practice for Design, Manufacture, Installation and Testing of Climbing Nets and Netting/Mesh used in Amusement Rides, Devices, Play Areas and Attractions; and ASTM F2479 -10 Standard Guide for Specification, Purchase, Installation and Maintenance of Poured-In-Place Playground Surfacing. Before and during new playground construction projects the Program coordinates between the operator (our client), Contracts, LBRE, the landscape architect, the equipment manufacturer, and the equipment installer, with the goal of ensuring compliance with the H&S Code.

Written Program

The Program group has drafted a written Playground Safety Program on behalf of the University describing playground safety policy. This Program document was last revised in 2005.

Recordkeeping

All inspection records and construction documents for new playgrounds are maintained by the Program. Records of



periodic high-frequency inspections are to be kept at each Operator's office.

Future Needs / Challenges

The Playground Safety Program is continuing to provide consultation on repairs and new playground construction campus wide. The future staffing needs of the Program will depend on these factors:

- *Interpretation of current regulations.* Applicability of the current code and regulations to existing playgrounds is not always clear. More clear guidance from GCO will be needed. If Stanford is to comply with a very strict interpretation, then more staff will be needed.
- *Amount of new playground construction.* Typically, new housing complexes and childcare centers include playgrounds. Depending on Stanford's expansion plans, several new playgrounds may be built.
- *Utilization level of third-part consultants.*
- *Demand for new or replacement equipment at existing playgrounds.*

Construction Safety

Background

As part of the University's commitment to a safe and healthy work environment the Program provides support to departments responsible for management of construction projects. Although the contractor is responsible for the health and safety of their employees compliance with applicable laws and regulations, Stanford exercises due diligence to enforce contract health and safety provisions and ensure that university employees, students and visitors located proximate to the work are adequately protected.

Program Elements

Facility Design and Construction Standards (FDCS) development

The Program has developed H&S related sections of the University's Facility Design and Construction Standard (FDCS) and maintains a seat on the FDCS Review Committee. Architectural and Engineering firms are required to adhere to these Standards when developing project specifications for the University.

Site Safety Plan Review

The Program provides review of the contractor's Site Safety Plan for contract compliance purposes. Stanford is not responsible for assessing the adequacy of such plans to protect contractor's employees or sub-contractors.

Site Safety Inspections

The Program, if requested, provides walk-around job site safety inspections to assess compliance with contract H&S provisions.

Hazardous Waste Disposal Assistance and Coordination

The Program interfaces with the EH&S Environmental Protection Program to provide disposal of construction related hazardous waste generated from job sites. Typical waste streams include asbestos, lead, mercury, PCBs, paint strippers, abandoned chemicals and mechanical system fluids.

Future Needs / Challenges

No changes are necessary at this time.

Hazardous Materials

Compliance and Management Program

Purpose	Provide guidance on hazardous materials storage ; Collect, Process, and Distribute chemical inventory and hazard data ; Report on use of hazardous materials; and Manage Chemicals of Interest .
Program Elements	Hazardous Materials Business Plan and Permits Chemical Inventory Information Management Chemical Safety Information Services Life Safety Box Program Chemical Facility Anti-Terrorism Standard (CFATS)
Business Drivers	<ul style="list-style-type: none"> • Chemical use • Regulatory reporting and permits • Department of Homeland Security (DHS)

Background

The Hazardous Materials Management (HMM) Program serves the University by providing guidance to the Stanford community on the storage and management of hazardous materials and by collecting, processing, and distributing necessary chemical inventory and hazard data.

HMM is primarily a compliance-driven effort focusing on providing institutional hazardous materials permitting and reporting mandated by several distinct regulations as detailed in this business plan. Hazardous material reporting is based primarily on the ChemTracker (CT)

online chemical inventory system. HMM supports the efforts of lab and shop personnel in maintaining accurate chemical inventories for their areas of responsibility. The HMM Program supports the chemical inventory and hazard information needs of a diverse range of University operations:

Scientific Research Faculty

Using ChemTracker, Principal Investigators (PIs) are able to manage and utilize their chemical inventories in a practical and cost-effective manner while helping to ensure their overall compliance with applicable local/ state/ federal regulatory requirements pertaining to

hazardous materials use and storage. The research population also relies on CT as a point source for chemical-specific safety information such as health hazard data and safe storage guidance.

Facilities Operations (Fac/Ops)

In addition to the ChemTracker services similarly provided to research groups, Fac/Ops relies on ad-hoc chemical use/storage reports for their own operational purposes (i.e., tracking of campus emergency generators, investigating wastewater compliance issues).

Department of Project Management



STANFORD UNIVERSITY

ChemTracker helps expedite new construction and renovation processes by working to provide, in conjunction with the University Fire Marshal's Office, existing chemical inventory data and UBC reporting tools during the formulation, planning, and design stages.

University Fire Marshal's Office (SUFMO)

The ChemTracker databases and electronic tools allow SUFMO staff to efficiently verify facilities' compliance with building and fire code requirements. Most commonly, existing and/or new chemical inventory data is processed to evaluate newly proposed building configurations as well as new research proposals involving hazardous materials usage / storage.

Laboratory Safety / Chemical Hygiene Program

EH&S and local laboratory safety personnel rely on ChemTracker to provide quick summaries of the range of chemical usage in specific laboratory or specific types of chemical usage across campus. The Chemical Hygiene Program, in conjunction with the Industrial Hygiene and Laboratory Safety Program, relies on the ChemTracker to generate updated campus-wide Cal/OSHA Regulated Carcinogens reporting.

Industrial Hygiene and Safety Program

EH&S industrial hygienists rely on ChemTracker to provide chemical usage information of sites where exposure assessment (i.e., reproductive hazard assessment, baseline evaluations) is necessary. ChemTracker chemical reference data is also relied upon as a major reference source for chemical safety information for EH&S and the general campus community.

Environmental Programs

ChemTracker assists to generate regulatory reporting such as Bay Area Air Quality Management District (BAAQMD) and California Accidental Release Prevention (Cal/ARP) reports. Additionally, ad-hoc reporting abilities allow University environmental programs to make campus-wide queries of any chemical of concern (to assist in study/ investigation of potential environmental releases).

Emergency Response Programs

Both University and municipal emergency response services rely on the Life Safety

Box Program (in conjunction w/ ChemTracker) to provide essential site-specific hazardous materials storage information. This immediate availability of information helps ensure prompt emergency response services, minimizing overall negative impact from deleterious incidents.

Chemical Waste Program

In efforts to promote University waste minimization, the Surplus Chemical Distribution Program is made accessible campus-wide by the ChemTracker application. To facilitate the process of making surplus chemicals available, ChemTracker allows University personnel to scan online through the current surplus chemical inventories by utilizing the ChemTracker query ability.

Program Elements

Regulatory Reporting

Hazardous Materials Business Plan and Permits

Regulatory Drivers include: California H&S Code § 11100 – 12000, 25509, 25506, 25503.8, 25244.10, 25249.10, 25282, 44342; County of Santa Clara Hazardous Materials Storage Ordinance; California Labor Code § 9020; California Public Resources Code Sections 21000-211768; 8 CCR § 2770.5, 3203, 85194; California Building Code Chapter 319; City of Palo Alto Municipal Code Chapter 13; SF Bay Regional Water Quality Control Board National Pollution Discharge Elimination System permit.

Background. The HMM Program annually generates the University's Hazardous Materials Business Plan and the Hazardous Materials Management Plans for all campus facilities with hazardous material inventories. The HMM Program's close communications with both City and County regulatory agencies helps to ensure continued compliance with hazardous materials management requirements and also helps minimize potential regulatory impacts on University operations. The regulatory reporting program element of the HMM Program is driven by many code requirements. ChemTracker enables all authorized users to maintain a current hazardous materials inventory through the

CT program. Users can update and make changes at any time. The information maintained in CT is used for many environmental compliance programs. The programs that require CT support include: Hazardous Materials Business Plan Reporting (HMBP/HMMP), California Accidental Release Prevention (Cal ARP), Spill Prevention Countermeasures Control (SPCC), Aboveground Tank Management (AGT), Toxic Gas Reporting (TGO), Bay Area Air Quality Management District (BAAQMD).

Program Components. Hazardous Material Management Plans (HMMPs) are generated on an annual basis for all buildings with hazardous materials storage and portable generators. Additionally, the university-wide Hazardous Material Business Plan (HMBP) is prepared annually. This involves generating and compiling inventory, campus maps, facilities floor plans, emergency response plans, monitoring plans, training programs. HMM Program staff conduct SAMON-ing to link chemicals in inventories to reference data, so that regulatory reporting and billing functions of ChemTracker to operate accurately. Quality control checks of the inventories are conducted. HMIS reports are test-run to uncover errors; quantities are checked for possible overstatements. The Plans are signed by the Associate Vice Provost for EH&S. The hard copies are submitted to Santa Clara County/City of Palo Alto, as appropriate. By 2013, these submittals will be conducted electronically via the California Environmental Reporting System (CERS) User Management system. Permit fees for all buildings and generators are paid centrally by EH&S followed by journal transfers to change back to departments for their individual fees. Update, assemble, and submit required regulatory reports on hazardous materials in use at Stanford. Includes annual Hazardous Material Management and Business Plans. Besides an inventory of hazardous materials these documents include information on buildings and facilities at Stanford, emergency response plans, monitoring plans, training programs, and above ground storage tanks.

Chemical Inventory Information Services



Regulatory Drivers include: Hazard Communication (8 CCR 5194), Federal Right-to-Know Provision (SARA Title III Section 311-312), and the Laboratory Standard (8 CCR 5191(f)).

Background. Chemical inventories are maintained for every area containing hazardous materials at Stanford University. Chemical owners (i.e. Principal Investigators, area managers) are responsible for ensuring their chemical inventories are up-to-date in ChemTracker (CT). The inventory is used for required regulatory reporting and more targeted and efficient health and safety evaluations. The chemical inventory regulatory reporting element is driven by the State of California H&S Code § 25509, and the County of Santa Clara Hazardous Materials Storage Ordinance.

Program Components. In maintaining the University's chemical inventory program, HMM staff is responsible for performing the following routine tasks: *CT application user-support:* For new users, usernames and passwords are provided. For the general user population, CT user support is provided typically via telephone or email; *Classroom and hands-on CT user training:* As needed, CT user training is offered for both groups and individuals; *Processing inventory data (SAMONSing):* As new inventory records are entered into CT, inventory items that are not automatically linked to chemical reference profiles by the Automated Matching of Names System (AMONSing) are then manually reviewed and linked to appropriate chemical reference profiles using the Semi-Automated Matching of Names System (SAMONSing); *Facilitating regulatory reporting efforts:* For special efforts such as initial inventory uploads and other non-routine inventory data handling, the HMM Program will assist as needed. Prior to any significant inventory data output, HMM Program will verify with appropriate safety coordinators (via e-mail) that their on-line inventories are up-to-date; *CT institutional database maintenance:* To ensure CT institutional data remains up to date, the HMM Program must regularly work with University data management groups, local safety coordinators, and the ChemTracker consortium program. Datasets that must be kept updated include, but are not limited to: building lists, room lists, department lists, and PI lists.

Chemical Safety Information Services

Regulatory Drivers include: Hazard Communication (8 CCR 5194), Federal Right-to-Know Provision (SARA Title III Section 311-312), and the Laboratory Standard (8 CCR 5191(f)).

Background. In conjunction with the ChemTracker Consortium Program, the HMM Program assists in providing access to chemical safety information to the Stanford community. These information resources provide chemical-specific health and safety information critical to ensuring safe chemical handling and storage by University personnel. ChemTracker and the associated chemical safety database and Material Safety Data Sheets (MSDS) service are the primary means of providing this information. For certain trade products, campus chemical users may need to request MSDSs directly from the chemical vendor or manufacturer.

Program Components. HMM staff provide consultation to Stanford personnel on the above databases and MSDS services.

Life Safety Box Program

Regulatory Drivers include: California H&S Code § 25503, Injury & Illness Prevention Program (8 CCR 3203), and Hazard Communication (8 CCR 5194).

Background. The Life Safety Box (LSB) Program is a critical element of Stanford's emergency response plan for areas storing hazardous materials. Every room or area that contains hazardous materials or processes at Stanford has a life safety box that contains information that is relied upon during emergencies by emergency response personnel and by inspectors during compliance visits. Life Safety Box contents include: Life Safety Box cover sheet (updated annually by HMM Program); Chemical storage map (updated by room occupants); Hazardous materials inventory printout (updated annually by HMM Program); and Emergency notification contact information (updated by room occupants).

Program Components. Inventories are updated by laboratory personnel at least annually. HMM staff generates inventory

reports after performing quality control activities, which includes running reports to assure that S/AMONSING is sufficient. Error checking reports are run to clear other input errors. HMM staff prints out the above elements of the Life Safety Box. The Safety and Compliance Assistance Program annually update Life Safety Boxes outside each hazardous materials storage/usage area.

Chemical Facility Anti-Terrorism Standard (CFATS)

Regulatory Drivers. This program element is driven by the U.S. Department of Homeland Security (6 CFR 27).

Background. The Department of Homeland Security (DHS) published the [Chemical Facility Anti-Terrorism Standards \(CFATS\) Interim Final Rule](#) (2007). This regulation requires all chemical facilities including colleges and universities to file a "Top Screen Report" identifying possessed volumes of specifically listed 'chemicals-of-interest'. The purpose for this report is to determine the risk level and necessity for implementing security plans for those facilities. As of October 2011, Stanford has met its initial regulatory obligations of CFATS, receiving verification from DHS that Stanford is not subject to the CFATS regulatory requirements for high-risk facilities per 6 CFR 27.

Program Components. Efforts involved include, but have not been limited to: Initial and periodic review of University chemical inventories to screen for Chemicals of Interest; and Documented communications with DHS. Per the CFATS compliance mandate, on-going vigilance will be required to assure Stanford continues to manage its future research programs in a responsible manner effectively supporting national security efforts.

Future Needs / Challenges

We anticipate that the major challenges for the HMM program will result from the following:

- *Rollout of New ChemTracker:* When launched in 2012, the newest version of the online chemical inventory system will require introducing and



retraining all ChemTracker users at Stanford. The ChemTracker consortium has been preparing training materials; however, we anticipate significant outreach efforts will be required to ensure a smooth transition.

- *California Environmental Reporting System (CERS) Conversion:* The

HHMP group, in collaboration with ChemTracker Consortium, will work with towards preparing Stanford for the 2013 deadline of electronic submittals of Hazardous Materials Management Plans and Hazardous Materials Business Plans as required by the California Environmental Reporting Systems (CERS).

- *Regulatory Focus:* As our ability to accurately maintain and report chemical inventories improves, regulatory agencies have increased expectations for accuracy and timely updates.

Industrial Hygiene

Purpose	Anticipate, recognize, evaluate, and control hazards.
Program Elements	Hazard Communication Chemical / Carcinogen Exposure Assessment Personal Protective Equipment Respiratory Protection Hearing Conservation Indoor Air Quality (including Mold) Odor Complaints Heat Illness Prevention Medical Surveillance Reproductive / Developmental Hazards Emergency Eyewash / Safety Shower Emergency Response Assistance Project / Product Review Utility Shutdowns in Areas Containing Hazardous Materials Baseline and Follow-up Surveys Monitoring Equipment maintenance Data Management
Business Drivers	<ul style="list-style-type: none"> • Chemical Use • Hazard Reports (including odor complaints, mold, etc.) • Job Safety Analysis / Job Hazard Analysis

The discipline of industrial hygiene is concerned with identifying and controlling potential chemical, physical, and biological workplace hazards by evaluating processes and facility designs using the following steps: Anticipation, Recognition, Evaluation, and Control. Using pre-established and approved methods determined by the nature of the hazard, industrial hygienists take qualitative and quantitative measurements of potential hazards in the workplace. The results are compared to recommended exposure guidelines or consensus standards. If the results reveal a possible health hazard, industrial hygienists will recommend methods for controlling the hazard. These methods may include engineering controls and appropriate safety practices for personnel, such as the substitution of safer materials, or the use of ventilation and personal protective equipment.

Hazard Communication

Background

As required by Cal/OSHA 8 CCR 5194 (Hazard Communication Standard), employers shall develop and implement a formal program that effectively informs employees of chemicals hazards in the workplace. Stanford University has developed its institutional [Hazard Communication Program](#) to guide SU departments on how they shall communicate chemical hazard information to their employees in non-research

laboratory work environments. NOTE: Guidance on chemical hazard communication in research laboratory settings is specifically covered in the SU Chemical Hygiene Program (as per Cal/OSHA 8 CCR 5191). The non-research populations that handle potentially hazardous chemicals at Stanford include but are not limited to building/ grounds maintenance personnel, janitorial staff, and other more specialized operational support units. Such groups participate in the SU Hazard Communication Program primarily to ensure they can receive adequate information on chemical hazards to safely handle and be properly protected during usage of chemical products in the workplace.

Program Elements

The OHS Program is responsible for developing/ maintaining the University's Hazard Communication Program and providing technical assistance to managers and supervisors as they fulfill their local chemical hazard communication obligations with their personnel.

Written Program

As required by Cal/OSHA 8 CCR 5194(e)(1)-(2), Stanford University has developed the University's written Hazard Communication Program which describes how University departments are to comply with regulatory requirements pertaining to:

Labels, Material Safety Data Sheets, Training, Communication with Non-University Personnel. In accordance with Cal/OSHA 8 CCR 5194(e)(3), Stanford's program also identifies that supervisors have the responsibility to ensure the written program is kept readily accessible for review in the workplace.

Labeling

As driven by Cal/OSHA 8 CCR 5194(f), the University's Hazard Communications Program specifies the required labeling practices necessary for informing users about hazards of chemical substances. Labeling requirements pertain to those chemicals that are: Supplied by outside vendors; Synthesized on-campus which do not leave the University; Contained in stationary process containers (e.g., tanks); and Transferred into and stored in another container.

Material Safety Data Sheets (MSDS)

Cal-OSHA 8 CCR 5194(g)(8) requires that all employers make MSDSs readily available to employees for all hazardous materials present in the workplace. MSDSs contain such information as physical characteristics, health hazards and emergency response procedures. EH&S has developed a selection of searchable commercial online MSDS providers accessible through EH&S's web page at <http://msds.stanford.edu>.



Training

Per Cal/OSHA 8 CCR 5194(h), the University's Hazard Communication Program requires training that covers the Program's purpose, employee rights/responsibilities, and basic orientation on how to review chemical hazard information. The OHS Program is responsible for providing technical instruction of the general Hazard Communication training, and supervisors are responsible for delivering operation-specific training with their employees. Per Cal/OSHA 8 CCR 5194(h)(2), employees are trained on the following: Requirements of the regulation, Hazardous operations in the work area, Location and availability of the written program, including chemical inventory and MSDSs, Methods to detect a hazardous material in the work area, Physical and health hazards of the substances in the work area, and measures employee can take to protect themselves from hazards, Details of the Hazard Communication Program, Employee rights. *Training Frequency:* Cal/OSHA 8 CCR 5194(h)(1) specifies that employees must be trained upon initial assignment and whenever a new hazard is introduced into the work area. *Non-Routine Operations:* To ensure compliance with Cal/OSHA 8 CCR 5194(e)(1)(b), supervisors shall inform employees of hazards and safety procedures for non-routine operations involving unlabeled pipes.

Chemical Inventory

As required by Cal/OSHA 8 CCR 5194(e)(1)(A), EH&S maintains an up-to-date chemical inventory database which includes hazardous chemicals used in each work area (e.g. laboratory, shop), quantities of these chemicals, primary contact, location, etc. Chemical inventory reports are placed in the *Life Safety Boxes* (LSBs) located outside of the door to each room storing chemicals. Based on the inventory information, the LSBs are labeled with hazard symbols representing the main hazard classes of chemicals stored for purposes of emergency response.

Non-University Employees

Per Cal/OSHA 8 CCR 5194(e)(2), the Hazard Communication Program identifies that the University representative for the non-University employee (e.g. supervisor, laboratory director, project manager) is responsible for providing the non-

University employee with information about hazardous substances that he/she may be exposed to while performing work at Stanford University.

Future Needs / Challenges

The OHS Program continues to maintain the program in accordance with Cal-OSHA 8 CCR 5194. As revisions to the Cal/OSHA regulations pertaining to hazard communication are expected to be revised in the 2012-2013 timeframe, OHS Program will need to update the University's institutional program as required.

Chemical / Carcinogens Exposure Assessments

Background

As required by Cal/OSHA 8 CCR 5155(e), whenever it is reasonable to suspect that employees may be exposed to concentrations of airborne contaminants in excess of levels permitted in Cal/OSHA 8 CCR 5155(c), the employer shall assess the work environment. At Stanford, OHS industrial hygiene professionals are trained to anticipate, recognize, evaluate, and make recommendations to control unacceptable workplace chemical exposures. The chemical exposure assessment strategy is the plan for recognizing, evaluating, and documenting all exposures, and for developing controls for occupational exposures that are judged unacceptable. There are five major steps in setting up a functioning occupational exposure assessment program: 1) Basic characterization, 2) Exposure Assessment, 3) Further information gathering, 4) Communication and Documentation, and 5) Reassessment. Per Cal/OSHA 8 CCR 5200-5220, exposure assessment and control requirements are further specified for recognized carcinogens.

Program Elements

Basic Characterization

The first step in the exposure assessment strategy is to characterize the workplace, workforce and environmental agents. The cognizant industrial hygienist (IH) shall conduct a survey of each workplace to obtain, as a minimum, the following information: *Description of operation* (includes a layout sketch incorporating relevant aspects of the factors listed below, along with the number of persons assigned to the operation/task and the specific work

area(s) occupied. The IH notes the frequency and duration of events involved with potential chemical hazards); *Identification of hazardous materials used* (the list shall include a description of use at each workplace. Reproductive hazards and carcinogens shall be specifically identified); *A list of physical hazards* (e.g., noise, ergonomic stressors, non-ionizing radiation, etc.) in the workplace that present significant risk including a brief description of their source(s); and *Description of existing controls* (e.g., industrial ventilation and personal protective equipment).

Exposure Assessment

The IH assesses exposures using all the information available. To make judgments about the acceptability of each exposure, the following steps are routinely conducted. *Define Exposure:* The IH uses all quantitative and qualitative data to determine the degree of personnel exposure i.e. estimate the exposure intensity. Estimates of the actual exposure levels will be made whenever feasible. When necessary, exposure monitoring is conducted to determine or confirm exposure levels. *Make Judgments on Acceptability of the Exposure:* The IH judges the exposure as acceptable, uncertain, or unacceptable as defined per Cal/OSHA 8 CCR 5155- Permissible Exposure Limits and other consensus standards (e.g., American Conference of Governmental Industrial Hygienists (ACGIH)). The IH then determines and documents the rationale for each judgment and evaluates/ determines the adequacy of existing controls. *Make Control Strategy Recommendations:* The IH makes appropriate recommendations regarding the workplace, workforce and environmental agents based on the results of the exposure assessments by using accepted industrial hygiene practices, which comply with appropriate regulatory requirements.

Further information gathering

Exposures that are not well understood, or for which acceptability judgments cannot be made with high confidence must be further characterized by collecting additional information. Information needs may be quantitative or qualitative depending on the exposure profile and judgment.



Communication and Documentation

Exposure assessment reports and records are critical elements of the exposure assessment process. Reports and records are needed to ensure effective communication of workplace findings and successful continuity of the industrial hygiene program.

Reassessment

The frequency of follow-up re-assessment is dependent on the exposure level and specific regulation requirements. Regardless of any activity's category, the IH may specify more frequent evaluations for specific workspaces or processes depending upon the industrial hygiene exposure assessment.

Carcinogen-specific assessment. In addition to the Cal/OSHA-listed airborne contaminants for which permissible exposure limits are established, Cal-OSHA has specified detailed requirements for carcinogen use in the workplace for the following:

Table with 2 columns: Section and Carcinogen. Lists various chemical agents like Methylene Chloride, Asbestos, Vinyl Chloride, etc.

Each regulation has various core requirements including: engineering controls; regulated areas; employee monitoring; medical surveillance; training; personal protective equipment; respiratory protection; and record keeping.

Future Needs / Challenges

OHS Program's chemical exposure assessment practices are maintained and updated in accordance with Cal/OSHA regulatory standards. As new regulatory updates occur or as new operations call for initial or updated chemical exposure assessment, the OHS Program is staffed prepared to provide support as necessary.

Personal Protective Equipment (PPE)

Background

The best means of protecting personnel from hazard exposure in the workplace is to eliminate the hazard. When this is not possible, engineering controls shall be the method of choice to eliminate or minimize hazard exposure in the workplace. When neither of these methods can be employed, activities shall implement a personal protective equipment (PPE) program to reduce or eliminate personnel exposure to hazards. To assist University groups with compliance with Cal/OSHA 8 CCR 3380-3385, the OHS Program has developed and maintains a written Personal Protective Equipment Program that specifies that certain physical hazards shall be identified via hazard assessment and that employees are subsequently provided with PPE and instructed on how to use and care for it.

Program Elements

Written Program

The OHS Program has developed a written Personal Protective Equipment Program which outlines responsibilities, hazard assessment, PPE selection, training, and recordkeeping. Supervisors shall ensure that assessment is conducted to determine if workplace hazards are present that necessitate the use of PPE. If such hazards are present, or likely to be present, activities shall accomplish the following actions: Select, and have each affected employee use, the types of PPE that will protect the affected employee from the hazards identified in the hazard assessment; Communicate selection decisions to each affected employee; and Provide training in the proper use, care, and limitations of PPE.

Hazard Assessment

In compliance with Cal/OSHA 8 CCR 3380(f), the OHS Program conducts baseline surveys and task-specific hazard assessments to assist supervisors in evaluating hazards and assigning the appropriate PPE.

PPE Selection

As covered in Cal/OSHA 8 CCR 3380-3385, employers are expected to provide appropriate selection of PPE. The OHS Program provides guidance on selection of the following forms of PPE: Eye and Face Protection; Head Protection; Foot Protection; Hand Protection; Respiratory Protection (refer to Respiratory Protection

Program); and Hearing Protection (refer to Hearing Conservation Program).

Training

Per Cal/OSHA 8 CCR 3380(c), employees shall be instructed to use PPE in accordance with manufacturer instructions. The OHS Program provides PPE training upon request by shop supervisors or departments. Training typically includes the purpose / selection of PPE, how to wear and adjust PPE, limitations, care and maintenance.

Future Needs / Challenges

The OHS Program plans to continue ongoing support of the PPE Program and, as resources allow, will re-evaluate PPE guidance materials and trainings available to the University population.

Respiratory Protection

Background

Where engineering, administrative, and/or work practice controls are not feasible and effective in reducing personnel airborne exposures to safe levels, CAL/OSHA 8 CCR 5144 requires employers to provide appropriate respiratory protection to employees. At Stanford, the EH&S- OHS Program administers the University's respiratory protection program, with medical support from the University's Occupational Health Center. On campus, respiratory protection is most typically assigned for use for certain facilities/ grounds maintenance activities, as well as for other specialty service operations (e.g., Public Safety). In research laboratories on campus, use of respiratory protection is most common for controlling of animal allergens. Currently, there are approximately 180 individuals enrolled in the University's Respiratory Protection Program. Also, approximately 120 School of Medicine students are annually provided respirator support services for their uses of N95 masks in clinical/ academic settings.

Program Elements

Written Program

In compliance with Cal/OSHA 8 CCR 5144(c), OHS Program has developed a comprehensive written respiratory protection program which include specific provisions and procedures in the following areas: exposure assessment; medical approval/surveillance; user training; respirator selection/fit testing; standard



STANFORD UNIVERSITY

operating procedures for respirator use, maintenance, inspection and repair; and record-keeping and program assessment.

Exposure Assessment

As per Cal/OSHA 8 CCR 5144(a)(1), OHS Program industrial hygienists will conduct workplace exposure assessment to determine the need for respiratory protection. Exposure assessment will typically include: evaluating the individual's operations; conducting air monitoring as needed; interpreting the assessment information; communicating findings to the employee and supervisor; and making appropriate recommendations. As the use of respirators is never the first line of defense, other options for possible control of airborne exposures are always evaluated during this process.

Medical Clearance / Surveillance

Most respiratory protection devices increase physical stress on the body, especially the heart and lungs. Individuals will not wear a respirator unless a determination has been made that they are medically qualified to do so. As driven by CAL/OSHA 8 CCR 5144(e), OHS Program requires employees to annually have respirator medical clearance prior to being granted their annual respirator use approval. This clearance process consists of: Employee completion of respirator medical evaluation questionnaire and submission to the SU Occupational Health Center (SUOHC); SUOHC review of questionnaire submission and follow-up evaluation as needed; and SUOHC confirmation of medical clearance for respirator use. If employees notice any health concerns or difficulties associated with respirator use, they are required to contact the SUOHC for follow-up assessment.

Respirator Training

As required by CAL/OSHA 8 CCR 5144(k), employers shall train respirator users in the proper selection, use, maintenance, and limitations of respirators. Personnel who issue respirators and supervisors of respirator users must also be trained in respiratory protection. The purpose of the training for issuers and supervisors is to further assure the proper selection, use, and maintenance of respirators. OHS Program provides training support for respirator use compliance as follows: *Live training*

(Respirator Use and Fit (EHS 5300) available upon demand); *N95 disposable mask user training* (Web-based training for N95 respirator users has developed and implemented in anticipation of the large volumes of N95 respirator users for pandemic flu support); and *Voluntary respirator user training* (Basic respirator safety information is provided via the "Voluntary Respirator Use Agreement" in accordance with CAL/OSHA 8 CCR 5144(k)).

Selection

Per CAL/OSHA 8 CCR 5144(d)(1)(B), only NIOSH or NIOSH/MSHA-approved respirators shall be used. To ensure proper respirator selection, the OHS Program ensures to take the following factors into consideration: **Nature of the Airborne Contaminant** (The considerations must include: physical and chemical properties of the airborne contaminant, the toxicological effects on the body, actual concentration of the airborne contaminant, permissible exposure limits, and warning properties. Also need to consider whether an oxygen-deficient or oxygen-rich atmosphere exists or may be created); **Nature of the Hazardous Operation** (For proper respirator selection, it is necessary to know the details of operations which require workers to use respiratory protection devices. This includes operation or process characteristics, work area characteristics, materials used or produced during the process, workers' duties and actions, and abnormal situation characteristics which may necessitate a different respirator selection (i.e., emergency)); **Time Respiratory Protection Is Required** (The length of time a respirator will have to be worn is a factor which must be evaluated. This is most evident when using a self-contained breathing apparatus (SCBA), where, by definition, the air supply is finite. However, time is also a factor during routine use of air-purifying respirators when worker acceptance and comfort are essential to ensure proper use of the device. EH&S must evaluate and recommend a changeout schedule for cartridge and filter use (CAL/OSHA 8 CCR 5144(d)(3)(C)(2)(b)); **Employee's Health** (Effective usage of a respirator is dependent on an individual's ability to wear a respirator, as determined by a physician in accordance with CAL/OSHA

8 CCR 5144(e)); and **Protection Factors** (CAL/OSHA 8 CCR 5144(d)(3)(A)).

The protection afforded by respirators is dependent upon the seal of the face piece to the face, leakage around valves, and leakage through or around cartridges or canisters. Depending on these criteria, the degree of protection may be ascertained and a relative safety factor assigned. Protection factors are only applicable if all elements of an effective respiratory protection program are in place and being enforced.

Fit Testing

As described in CAL/OSHA 8 CCR 5144 Appendix A, every worker who wears a tight-fitting respirator must be either quantitatively or qualitatively fit-tested to identify an acceptable make, model and size respirator to use. Qualitative fit tests involve a test subject's response (either voluntary or involuntary) of a challenge chemical. Quantitative fit tests involving measuring the fit factor of the respirator using a computer software system. Currently, EH&S conducts a quantitative fit test for every respirator user except the N95 respirator users in which a qualitative test is performed. All personnel required to wear respirators are to be fit-tested annually at a minimum. Exceptions: when the respirator is used voluntarily (initial fit test) or if changes are observed in the user's physical condition that could affect respirator fit. No fit testing is performed for hoods, helmets or other loose-fitting face-pieces.

Standard Operating Procedures (SOPs)

Use, Maintenance, Inspection, and Repair (8 CCR 5144(g-h))

EH&S assists supervisors in establishing written standard operating procedures for the proper use of respirators in routine and emergency situations. EH&S conducts field inspections to check that supervisors are properly enforcing respirator maintenance, inspection and repair in the work unit. These inspections are recorded and included in the record keeping system.

Recordkeeping and Administration (8 CCR 5144(l-m))

Medical clearances, respirator users' training records, fit testing documentation, respirator selection sheet and work place evaluations are documented and included in an EH&S record keeping system. EH&S



STANFORD UNIVERSITY

evaluates program effectiveness by soliciting worker opinions, supervisors' observations and observing workplace respirator practices.

Future Needs / Challenges

The Respiratory Protection Program will continue to support the University's needs with safe respiratory protection. The OHS Program actively maintains and evaluates the Respiratory Protection Program to meet the Cal/OSHA regulation on respiratory protection, 8 CCR 5144. Near term, the OHS Program anticipates increased service demand as the University's implementation of the new CAL/OSHA Aerosolized Transmissible Disease Standard 8 CCR 5199 takes hold. This new standard will likely result in increased need for N95 respirator fit testing and training.

Hearing Conservation

Background

Workplace noise can cause hearing loss, create physical and psychological stress, and contribute to accidents by making it difficult to communicate. Per CAL/OSHA 8 CCR 5095 - 5100, when an employee is exposed to excessive noise (i.e., exceeding 85 decibels Time-Weighted Averaged (TWA) over the eight-hour work day), he/she must be included in a hearing conservation program. The Industrial Hygiene/ Safety staff is responsible for developing, implementing, and administering the Stanford University Hearing Conservation Program. The departments or occupations that may be at risk to elevated noise levels include the following: Buildings and Grounds Maintenance and Student Housing.

Program Elements

Written Program

A written program although not required by CAL/OSHA expresses the full intent of Stanford University to protect and preserve the hearing of its employees. The written program addresses noise exposure measurements, engineering and administrative noise controls, audiometric testing, hearing protection, training and record keeping.

Exposure Assessment

Per CAL/OSHA 8 CCR 5096, OHS Program conducts noise exposure assessments to determine if administrative

and engineering controls are needed and how they should be implemented. In accordance with CAL/OSHA 8 CCR 5097(b), the assessment will identify areas or processes that require noise abatement. The assessment should be periodically re-evaluated whenever changes in work practices or equipment may change noise exposures. Initial and periodic noise monitoring involves: *Initial screening of workplace operations* (Conducting employee and supervisor interviews; Description of work operation/process including work practices and procedures, frequency and duration of operation and a diagram of the work area; Identification of all noise producing equipment; Description of all personal protective equipment used and engineering controls and evaluation of their effectiveness; and Number of personnel assigned to each work operation/process); *Developing a sampling strategy*; *Conducting the personal and/or area noise monitoring* (Per CAL/OSHA 8 CCR 5097(b)(2)(D), instrumentation (e.g. dosimeters or sound level meters) used to measure employee noise exposure is calibrated to ensure measurement accuracy. As specified by CAL/OSHA 8 CCR 5097(b)(2)(C), assessment of noise exposures are to evaluate all continuous, intermittent and impulsive sound level from 80 db to 130 db shall be integrated into the computation); *Interpreting the noise exposure* data and making appropriate exposure control recommendations; and *Documenting and communicating* assessment findings to the employee and supervisor. If an employee's eight-hour time weighted exposure (8-hr TWA) is greater than 85 dBA, the employer must provide audiometric testing, training, and the use of suitable hearing protection devices.

Audiometric testing

In accordance with CAL/OSHA 8 CCR 5097(c), audiometric tests are conducted in order to determine if an individual's occupation is adversely affecting his/her hearing, and to assess the effectiveness of the hearing conservation program. An outside medical vendor or the University's Occupational Health Center will conduct the audiometric testing. OHS Program coordinates efforts to have employees screened for a baseline audiogram and annually. Evaluation of audiograms shall be done in compliance with CAL/OSHA 8 CCR 5097(d). Employees shall be informed in writing within 21 days when

an audiogram indicates a standard threshold shift which is determined to be work related.

Hearing Protection Devices

As required by CAL/OSHA 8 CCR 5098, OHS and supervisors shall make hearing protectors available to all employees exposed to 85 decibels or greater in an 8-hour time weighted average. Also employees who have experienced a documented standard threshold shift or have not obtained a baseline audiogram will wear hearing protectors. OS&H shall use one of the methods described in CAL/OSHA 8 CCR Appendix E to estimate the adequacy of the hearing protector. Employees shall be given the opportunity to select their hearing protectors from a variety of suitable types. Proper initial fitting and supervision of the correct use of hearing protectors shall be provided. Workplaces in which the noise level exceeds 85 decibels will have signs posted to read "Hearing Protectors Required".

Training

To ensure compliance with CAL/OSHA 8 CCR 5099, on an annual basis, the affected employees must receive training that includes information regarding the adverse effects of noise on hearing and the purpose of audiometric testing. Hearing protectors' purpose, advantages, disadvantages, types and instructions on selection, fitting, use and care are also explained. A copy of CAL/OSHA 8 CCR 5095 - 5100 is posted in the workplace and provided to affected employees.

Recordkeeping

Per CAL/OSHA 8 CCR 5100, noise exposure measurements will be retained by OHS for 2 years and audiograms must be retained for the time of employment. Noise hazard training is also documented and retained for at least 2 years.

Future Needs / Challenges

The Hearing Conservation Program is continually maintained according to CAL/OSHA 8 CCR 5095 - 5100.

Indoor Air Quality (including Mold)

Background

The indoor environment is a result of the interaction between many factors - the



building's location, climate, construction methods and materials, renovations, occupant activities, furnishings. With the focus on energy conservation in the 1970s came the idea that "tighter is better." Buildings were constructed to prevent infiltration and ex-filtration, but compensation was not always made for the loss of natural ventilation. Consequently, the number of employee complaints of sickness in the workplace began to rise, and indoor air quality (IAQ) became an occupational health issue. Evaluation of IAQ issues requires sound industrial hygiene knowledge and practice. There is no "magic formula," nor can every investigation be conducted exactly the same way. The IH will have to plan the evaluation based on employee complaints, visual inspection and professional experience.

Program Elements

Initial Assessment

Evaluate complaints and determine if a potential problem exists, relying on field observations and occupant interviews.

Site Visit

Verify information obtained during the interview process and identify processes, equipment or procedures that require further investigation. For example, ventilation system testing by HVAC shop and/or sample collection by IH.

Moisture Intrusion / Building Mold

Molds are forms of fungi that are naturally occurring and found in both indoor and outdoor environments. Individuals are exposed to molds on a daily basis and most workers will not be affected by molds. However, if mold is growing excessively in the workplace, a small percentage of individuals may experience some types of illnesses (mostly temporary that can be controlled by limiting exposure to molds). For certain situations where water damage or mold amplification has been identified as an issue, the OHS provides guidance on properly managing water damage as well as mold clean-up. For small scale situations, EH&S fact sheets have been developed for guidance to facilities and lab managers.

Contaminant monitoring

In general, air samples should be taken only when there is visible evidence and

when employee symptomology is suggestive of a causative agent. If sampling is indicated, it is usually best to begin with screening samples. Sampling should be done throughout the work day, such that both "worst case" and typical periods are likely to be sampled.

Consultation with Occupational Medicine Physician

If necessary, the OHS group may discuss issues with an Occupational Medicine physician and/or refer the concerned employee and/or his/her physician to the Occupational Medicine Physician.

Remediation

Successful IAQ remediation depends on reducing or eliminating air contaminant levels (if found) and addressing health complaints. Recommendations and guidelines will be used with the understanding that there may be other physical factors (ergonomic design, noise, vibration, lighting, video display terminal usage) or less defined contributors (comfort level, stress factors, job satisfaction, psychosocial influence) involved. Remediation should be tempered by economics-inexpensive solution are more likely to be accepted and implemented.

Future Needs / Challenges

Indoor air quality assessment continues to be a commonly requested item that the OHS Program provides routine support for. Besides the seasonal peak during the "allergy seasons", other common triggers for indoor air quality support are when new construction or renovations occur nearby occupied areas. Despite EH&S' ongoing proactive efforts to help prevent IAQ impacts from construction activities, OHS responsive support on indoor air quality concerns is essential to helping preventing occupational illnesses and related losses in work productivity.

Odor Complaints

Evaluation, Response, and Follow-up

Background

Odor complaints are generally characterized as acute issues given they have a transitory nature; they may disappear as mysteriously as they appear, depending on the odor properties of the material involved. In most cases, odor problems do not pose long-term

occupational health hazards. This has been verified through OSHA investigations whereby no substance-specific OSHA levels have been exceeded. Rather, the odors create a nuisance, with some individuals developing some irritation (e.g., watering eyes, headaches, etc.) or other symptoms that are often transitory, as well. Similar to IAQ concerns, odor complaints do not typically result in occupational health exposure hazards, however if not promptly and properly addressed, odor issues can result in loss of worker productivity, and can progress into more significant compromises with employee health risk perception and employer-employee trust.

Program Elements

Employee Interviews

The IH or other professional staff assesses the situation (i.e., ideas regarding the source of the odor, duration, any adverse health effects, etc.).

Site Visits

An immediate site evaluation may be needed if odors indicate an acute exposure hazard.

Hazard Identification and Control

The interview and/or site visit will usually reveal the odor source (e.g. roofing project, laboratory process, car exhaust). The Industrial Hygienist will then take steps to control the odor. For example, if the odor is from a roofing project, the project manager may be asked to seal nearby intake vents, work downwind from vents or work during off-business hours.

Contaminant Monitoring

When indicated, monitoring of specific contaminants is conducted.

Future Needs / Challenges

On an ongoing basis, odor complaints are carefully managed to ensure timely and effective response is provided to concerned building occupants. This discretionary support service will continue to remain essential in supporting the University's overall mission with injury/ illness prevention in the workplace.

Heat Illness Prevention

Background

Heat stress is defined as any combination of work, airflow, humidity, air



temperature, thermal radiation, or internal body condition that strains the body as it tries to regulate its temperature. When the strain to regulate body temperature exceeds the body's capability to adjust, heat stress has become excessive. Such excessive stress can potentially lead to heat illness, which can become a life-threatening condition.

Per Cal/OSHA 8 CCR 3395, Stanford University shall ensure employees working in outdoor environments are protected from the stressors that can potentially lead to heat illness. The standard requires supervisor and employee training, provision of drinking water, employee access to shade, and high-heat procedures.

Program Elements

Training

To help the University comply with Cal/OSHA 8 CCR 3395(f), the OHS Program has developed and made available heat illness prevention training for both supervisors and employees. Both trainings are provided through the EH&S website, but can also be provided as a live class upon requested. The training sessions deliver the basics on heat illness prevention including but not limited to:

Heat illness symptoms, Safe work practices, and Emergency response procedures.

Written Program

As required by Cal/OSHA 8 CCR 3395 f[3], employers are to have written procedures for heat illness prevention. As such, the OHS Program has produced a template form (located on the EH&S website) to help departments document and adopt local heat illness prevention procedures, including the following:

Procedures for complying with the standard (e.g. providing shade); Local response for the report of heat illness symptoms; and Procedures for contacting and directing emergency services to the affected employee(s).

Future Needs / Challenges

OHS will continue to monitor and adopt any new provisions of the relatively new heat illness prevention standard.

Medical Surveillance

Background

Medical surveillance is a primary prevention tool whereby occupational health care professionals can provide for early identification of medical conditions that could potentially lead to adverse impacts on work-related health. Based on assessment of workplace hazards by industrial hygiene professionals, medical surveillance may be recommended depending on the nature of workplace health exposures identified. The secondary purpose of medical surveillance is to assure compliance with federal and state regulations that trigger medical monitoring when employees use certain materials. In California, Cal/OSHA (Title 8, CA Code of Regulations) establishes medical surveillance requirements for workplace exposure to specific chemicals and physical agents. Cal/OSHA requires that employers offer such a program, at no cost to employees identified to have specific workplace exposures. At Stanford, the Occupational Health Center provides such medical surveillance services. Specific test results and other personal medical information generated by these exams are kept confidential between the employee and the physician. The physician will determine the scope of the exam, then notify the supervisor and EH&S- OHS Program based on the surveillance results. The OHS Program provides consultation to supervisors to help determine any necessary improvements to help address potential workplace exposure concerns.

Program Elements

Needs Assessment

Information from baseline surveys and other chemical exposure assessments are used to identify job categories that require any forms of medical surveillance. Some job categories where medical surveillance is generally necessary include employees involved with: Biohazardous agents, Animal handling, Clinical environments, Noise exposure, Respirator use, Specific hazardous chemicals (e.g., regulated carcinogens, organophosphate pesticides), Asbestos-related operations, Laser use , Diving operations (e.g., researchers at Marine Hopkins), Driving commercial vehicles, Hazardous materials emergency response, and Police duties. Examinations may also be recommended for other personnel based on job duties, exposures, individual medical histories, and departmental accident and injury experience.

Laboratory Animal Occupational Health Program (LAOHP)

In assisting the SU Administrative Panel on Laboratory Animal Care (A-PLAC) with its external regulatory compliance, the LAOHP helps protect individuals from work-related risks associated with handling vertebrate animal species. Primary efforts of the LAOHP include: Providing risk-based medical screening to identify personnel elevated risks for animal-related allergies and other health conditions; Providing necessary vaccinations/immunizations for infection prevention; Delivering awareness information on potential health risks and preventive measures with working with specific animal species; Protecting the health of research animals from certain transmissible diseases.

Future Needs / Challenges

The OHS Program continues to monitor University operations to help determine where additional medical surveillance efforts may be required. As the University's Occupational Health Center further enhances its service capabilities, it continues to work closely with the OHS Program to streamline and better integrate medical surveillance with other occupational health and safety efforts.

Reproductive / Developmental Hazards

Background

Employees during various periods of their employment may be concerned about potential exposures to workplace hazards that could adversely affect the human reproductive process. These effects may occur through either parent's reproductive cells, prior to conception or during the development of the fetus. A reproductive hazard that has its effect during fetal development is a developmental hazard. Many potential stressors, which are considered reproductive hazards, also cause injury to other human organ systems. Cal/OSHA (Title 8, CA Code of Regulations) already regulates many of them based on these other effects. Therefore, if the worksite is following regulations and exposures are below established permissible levels for these regulated hazards, the reproductive system is also protected. However, in some cases reproductive effects occur at lower



exposure levels than these other effects. In these cases, the current exposure standards do not protect the reproductive system. These hazards are the primary concern of this chapter. Much is not known about reproductive hazards. A hazardous workplace exposure may, in some cases, occur far removed from its ultimate reproductive effect. Flexibility in handling these issues is, therefore, a necessity to allow changes to procedures and processes as knowledge is gained.

Program Elements

Written Program

A written program is established detailing guidelines for protection from potential reproductive and developmental hazards. The program provides information regarding the background of reproductive and developmental health hazards, responsibilities (EH&S, Supervisors, Faculty/Staff/Students, Occupational Medicine Physician and Human Resources), methods of control, and communication/training/education.

Assessment

OHS staff responds to questions regarding potential reproductive hazards in the work place on a case-by-case basis. With careful discretion, OHS staff follow-up on a reproductive hazard concerns by: Reviewing the employee's submitted Reproductive Health Hazard Questionnaire, Interviewing the concerned individual, Conducting a site visit,

Assessing occupational stressors (e.g., chemical, physical, radiological and biological hazards), Consultation with other health and safety professionals (Occupational Medicine Physician, Biosafety, and Radiological Safety Managers), and Providing written recommendations. In conducting reproductive hazard consultations, the OHS staff reference the California Proposition 65 list, which identifies chemicals known to the State of California to cause cancer or productive toxicity. Other guidelines are referenced (e.g., State of Washington's Department of Labor's list of agents known to be human reproductive hazards, etc.).

The overall goal is to keep the utilization of known reproductive stressors as low as reasonably achievable. The primary methods of achieving this goal is through the use of engineering controls,

substitution of materials where possible, and the judicious use of personal protective equipment. In most cases, the potential for exposure to reproductive hazards does not call for the removal of an individual from a position or job. However as necessary, OHS staff may recommend temporary task modification to avoid/ minimize potential exposure(s).

Future Needs / Challenges

The Reproductive and Developmental Health Protection Program is continually monitored and updated as appropriate.

Emergency Eyewash / Safety Shower

Background

If an individual is exposed to a toxic, corrosive, or severely irritating material, it is critical that the affected body part is flooded with water. Hence, emergency eyewash and shower equipment are located, per the requirements of the Cal/OSHA regulation (8 CCR 5152), in close proximity to locations where employees may incur injuries in the event of a spill or other type of accident or incident involving such substances.

Program Elements

Location

Emergency eyewash and shower equipment are placed in laboratory buildings and other locations where employees can come in contact with a substance which is toxic, corrosive, or severely irritating. The standard requires that these units be within 10 seconds of such work areas.

Maintenance

The plumbing shop conducts monthly inspections to ensure the equipment is functioning properly.

Surveys

Per 8 CCR 3203, employers are required to conduct scheduled periodic inspections to identify and evaluate unsafe conditions and work practices. As part of these surveys, supervisors are responsible for inspecting that their work areas have properly functioning emergency eyewash and shower equipment in required locations. Also, when EH&S reviews new experimental protocols and Standard Operating Procedures, the emergency

eyewash/safety showers are also checked to ensure they are currently inspected, free of obstruction, and within 10 seconds of the hazardous operation.

Plan Reviews

EH&S reviews new construction projects to ensure that ANSI-approved emergency eyewash shower stations are installed where required.

Training

Currently, training regarding eyewash and safety showers is addressed in EH&S's Laboratory Training (EH&S 105). In new employee orientations and tailgate trainings provided by the supervisors, the local emergency eyewash/safety shower is identified.

Future Needs / Challenges

The OHS Program is monitoring proposals to modify the existing Cal/OSHA Standard. Some of the proposed changes to the program may have significant cost to the University with minimal health & safety benefits. The OHS will coordinate with other key departments on campus, such as Utilities' Environmental and Water Quality Program and the Plumbing Shop, and prepare a response to Cal/OSHA on behalf of the University.

Emergency Response

Background

When a chemical spill occurs, the Emergency Response Team assesses it, and then cleans it up. For highly unusual chemical spills the OHS staff can assist the ERT in selecting the appropriate PPE. When air monitoring is appropriate (i.e., when it is necessary to quantify that the chemical hazards have been adequately abated), the OHS staff provides technical assistance regarding the monitoring to the ERT staff. In some cases, the OHS staff conducts the monitoring prior to the area be opened for general reoccupancy. If building occupants have any health-related questions related to the chemical spill (e.g., regarding their potential exposures, symptoms, etc.), the OHS staff provides technical consultation. Where appropriate, the OHS staff refers building occupants to health professionals for further medical consultation.

Future Needs / Challenges



Support of the Emergency Response Team is continually monitored and changes are made as necessary.

Project / Product Review

Background

Renovation, demolition, and remodeling projects can impact building occupants by the use of common products such as paints, roofing compounds, cleaning products, carpet glues, waterproofing materials for decks, etc. which generate odors, or by project which create a lot of dust or noise. Taking measures before the project begins can avert a lot of concerned calls from building occupants. Measures involve: having products reviewed by EH&S; notifying the building occupants about the impending project; and managing the project such that odors, dust and noise are minimized.

Program Elements

Product Review

Projects which require specific review by EH&S's OHS Program include projects: where large quantities of products are used (e.g., large scale roofing or painting project); of long duration; which are conducted in close proximity to occupied area; and which are conducted in a highly sensitive area (e.g., in Jordan Hall near the Infant Studies Program). Project Managers are requested to submit the following information to the OHS Program: Specific Location of Project; Duration of Project; General Description of Project; MSDSs for Products to be Used; Quantity of Each Product; Description of How the Products will be Applied (e.g., sprayed, rolled, etc.); Description of How the Products will be Used (e.g., according to manufacturer's instructions); Frequency of Application of Products; and Description of Measures Taken to Prevent/Reduce Odors, Noise.

Project Review

In addition to reviewing the products, the OHS Program reviews methods to control odors, noise and dust. Measures for controlling odors from outdoor projects might include a combination of: keeping windows and doors closed shut; sealing off air intakes and other entry paths with polyethylene sheeting; shutting off the ventilation to the affected areas; and conducting the project after hours or on weekends. Measures for

controlling odors inside the building might include a combination of: increasing the building ventilation; installing temporary fans; and conducting the project after hours or on weekends. Measures for controlling dust might include a combination of isolating the area, enforcing good housekeeping, etc. Measures for controlling construction-related noise, which generally does not pose an occupational health hazard to building occupants, might simply mean informing occupants of the activity, or conducting work after hours or on weekends.

Notification of Building Occupants

Project managers are responsible for informing building occupants about the nature of the project, timeframe, possible impacts, etc. EH&S has developed a project notification form, with assistance from various departments, entitled, "Announcement of Stanford University Building Renovation Project". This is a communication tool project managers can use.

Currently this form is available on-line and from the OHS Program.

Future Needs / Challenges

EH&S project/product review processes will be reviewed and updated as appropriate. The OHS group intends to meet with DPM Project Managers, Building Managers and Zone Managers periodically as a forum to update each another concerning relevant issues and recent developments.

Utility Shutdowns

Background

When certain utilities in laboratories (e.g., fume hoods, domestic water) are shutdown either on a non-routine or emergency basis, maintenance personnel are often concerned about being exposed to chemicals while working on the system. The OHS Program addresses their safety concerns by reviewing the proposed operation and the PPE to be worn. When appropriate, the OHS Program will recommend alternative practices or PPE.

Future Needs / Challenges

Procedures for utility shutdowns are reviewed and updated as appropriate.

Baseline and Follow-up Surveys

Background

Per 8 CCR 3203, employers are required to conduct scheduled periodic inspections to identify and evaluate unsafe conditions and work practices. The OHS Program assists departments by conducting baseline and follow-up industrial hygiene/safety surveys.

Survey Components

The survey involves: Interviewing the supervisor (and representative employees) regarding the operations performed by the shop; Evaluating potential chemical and physical hazards; Reviewing documentation (e.g., SOPs, training records, etc.); When indicated, conducting area or personnel monitoring (e.g., air, noise, etc.); Preparing a written report of the findings; Debriefing the supervisor on the findings; and Providing on-going consultation to the supervisor to correct any deficiencies identified.

Future Needs / Challenges

Since 1993, the OHS Program has conducted baseline surveys for the following Facilities Operations shops: Stanford Blood Center, Grounds, Events Services, Labor, HVAC (Heating, Ventilation and Air Conditioning), Plumbing, Electric, Paint/Sign/Glass, Preventative Maintenance, Garage, Carpentry, Lock, High Volt, Water, Steam, Utilities – Civil and Construction Group, EMCS (Energy Management and Control Systems) and Fire Alarm. The OHS Program has also conducted baseline surveys for two Residential & Dining Enterprises Shops: Trades (Shop 23) and Carpenters (Shop 24). In addition, the OHS Program has conducted baseline surveys for the Emergency Response/Chemical Waste Program, two Athletics Shops: Golf Course and Maintenance, and four Academic areas: Physics Department, Mechanical Engineering Department, Veterinary Services Center (VSC) and Gravity Probe-B Project. The OHS Program plans to revisit Facilities Operations shops and conduct more baseline surveys.

Monitoring Equipment

Background

The maintenance and calibration of industrial hygiene equipment is critical to



ensure that precise and accurate measurements of the workplace are made. Many far-reaching decisions are based on the results of workplace evaluation of toxic chemicals or harmful physical agents. An underestimation of an employee's or group of employees' exposure may result in medical as well as legal complication. Overestimation may result in costly and unnecessary control measures, reduction in production, and employee relations problems. Determination of any given employee's "actual" exposure is a difficult task. To minimize errors and most closely approximate employees' exposure, it is necessary to have a comprehensive calibration program, in addition to professional experience, sound sampling strategies and established analytical procedures.

Equipment List

Most types of EH&S equipment require calibration. Many must be field calibrated by the user. Examples of field calibrated items are hand sampling (detector tube) pumps, personal sampling pumps, sound level meters, rotameters, toxic gas monitors, combustible gas monitors and oxygen meter. The manufacturer or other accepted calibration laboratory must calibrate certain equipment periodically. Below is a list of EH&S equipment.

Owner	Equipment
OHS	BIOS Dry Calibrator
OHS	Draeger Pump (2)
OHS	DuPont Air Samplers (3)
OHS	Honeywell HEPA IAQ Units (2)
OHS	3M Office Air Cleaner
OHS	Kurz Velocity Meter
OHS	Lumidor Micromax Meter
OHS	Quest Octave Band Filter
OHS	Quest Sound Level Meter
OHS	Quest SLM Calibrator
OHS	SCK Airchek Samplers (lo flow) (3)
OHS	SKC Airchek Samplers (hi/lo) (6)
OHS	TSI Dust Trak
OHS	TSI Q-Trak IAQ meter (2)
OHS	TSI Air VelociCheck Air Velocity Meter (3)
OHS	Amprobe Digital Thermo/Hygrometer (3)
OHS	Biotest Hycon Air Sampler
OHS	Greenlee Digital Light Meter
Environmental	MultRae Gas Detectors (2)
Environmental	Jerome Hg Analyzer
Environmental	Eagle 4-gas detector

Future Needs / Challenges

The OHS staff currently performs field calibration for appropriate equipment such as personal sampling pumps, noise dosimeters, and sound level meters and maintains the factory calibration schedules of all equipment listed. No changes are

currently planned in regards to maintenance of OHS equipment.

Data Management

Background

IH data regarding ergonomic evaluations, respirators, air monitoring, noise, etc. are maintained in a database. Data entry and maintenance of the system is another task of the OHS Program. For the Asbestos and Lead Program, electronic data is stored in a series of (FileMaker Pro) linked databases. The main database (Project Info) contains core project/incident information. Other databases linked to project info include invoice and time tracking, archive documents, asbestos and lead survey info, exposure monitoring, on-site analysis, project photos and diagrams, sampling and lab data, warning sign tracking and asbestos building inventory. Hardcopy data for large projects is stored in file folders. Hardcopy for small projects is stored in binders.

Future Needs / Challenges

Computer data system improvements will be needed to more efficiently capture and maintain industrial hygiene/ safety information for easy reference in the future.

Laboratory Safety

Purpose	Protect laboratory personnel from potential health and safety hazards.
Program Elements	Chemical Hygiene Plan Laboratory Safety Plan(s) Standard Operating Procedures (SOPs) Exposure Assessments / Medical Monitoring Safety and Compliance Site Visits of Laboratories Laboratory Assessments Accident and Incidents (follow-up) Hazard Information (Development and Promulgation) Nanomaterials Toxic Gas (Oversight & Management) Controlled Substances & Precursor Chemicals Select Agent and Toxins Laboratory Ventilation & Engineering Controls Laboratory Plans Review University Policies related to Laboratories
Business Drivers	<ul style="list-style-type: none"> • Laboratory Safety Culture • Increased regulatory focus • Drug Enforcement Agency (DEA) inspections • Nanomaterials research • Expanding laboratory environment

Purpose

The goal of the Laboratory Safety & Chemical Hygiene Program is to protect laboratory personnel from potential health and safety hazards generated in the course of conducting research and teaching in the laboratory environment.

Regulatory Drivers

California's Occupational Safety and Health Administration (Cal/OSHA) Occupational Exposure to Hazardous Chemicals in Laboratories (8 CCR 5191) provides the cornerstone for health and safety in Stanford University's research laboratories. Numerous other Cal/OSHA regulations apply to the laboratory environment, including Injury Illness

Prevention Program (8 CCR 3203), Regulated Carcinogens (8 CCR 5200), Airborne Contaminants (8 CCR 5155), and others.

Types of Potential Hazards

At Stanford University, there are approximately 575 Principal Investigators conducting research and teaching students.



The Laboratory Safety & Chemical Hygiene Program provides specialty safety and health support and oversight for activities in laboratories around the use of hazardous chemicals and physical hazards. The range of issues arising in laboratories addressed by the OHS Program via the Laboratory Safety & Chemical Hygiene Program is extremely broad. Staff evaluate and address: chemical exposure assessments involving carcinogens, reproductive toxins and other hazardous chemicals; operational hazards posed by laboratory equipment such as centrifuges and laboratory cranes; electrical and lockout & tag issues associated with experimental lab set-ups and laboratory equipment; toxic gases operations; compressed gas use and storage; cryogenic liquid use and storage; security, licensing and hazard assessment associated with controlled substances and precursor chemicals; security and hazard assessment of CDC select agent toxins; laboratory operations requiring medical surveillance for laboratory personnel; noise hazards generated by laboratory operations; and laboratory ergonomics issues from microscopy, pipetting, animal tagging computer use, etc.

Control Measures

To control these hazards, OHS staff provides recommendations for appropriate engineering controls, personal protective equipment use, and work practices to minimize exposures. OHS staff also offers the following services: chemical hazard information and assessment to emergency responders regarding chemical spills and to medical providers for exposures to researchers; technical input on new laboratory construction and design so that resulting laboratory facility meets the scientific needs of the researchers, while satisfying health and safety issues and regulatory requirements; development of procedures for the certification of various laboratory equipment such as fume hoods, walk-in hoods, special purpose hoods; and participation in the development of university policies and guidelines for management issues affecting laboratories, such as the restriction of children in laboratories.

Integration of Disciplines and Services

In many laboratories, the activities performed may have biological, radioactive, and physical hazards as well as chemical hazards. Thus, the Laboratory Safety & Chemical Hygiene staff also partners with other EH&S units, such as Biosafety, Fire, Hazardous Waste, Health Physics, and Emergency Preparedness. Staff coordinate with these other specialists to address all the EH&S issues from cradle to grave. For example, chemicals administered to laboratory animals are reviewed for potential hazards to the researchers during the mixing and application to the animal, as well as to the husbandry staff who manipulate potentially contaminated bedding; associated hazardous waste management issues addressed. Or, OHS staff examine all the potential reproductive stressors to a laboratory worker by joining forces with the Health Physicist and Biosafety Officer. The Safety & Compliance Program (SCA) supports the Laboratory Safety & Chemical Hygiene Program by conducting routine visits of laboratories to ensure they are compliant with numerous regulations such as hazardous materials storage, etc. The Hazardous Materials Management Program provides critical reporting information regarding chemical management as well as Material Safety Data (MSDSs) to users. The goal of the Laboratory Safety Program & Chemical Hygiene Program is to partner with the different EH&S specialists, in order to deliver services in a streamlined, effective manner to researchers. Through the Laboratory Safety & Chemical Hygiene Program, our clients have a single point of contact to address their often complex laboratory issues, thereby simplifying their interactions with EH&S.

Program Elements

Many of the core OHS Programs, which support the overall University, are tailored to meet laboratory settings via specialized trainings and evaluations. These core programs are described in the other sections of OHS Program's business plan: Assisting Emergency Response Personnel, Carcinogen Control, Chemical Exposure Assessments, Computer Ergonomics, Compressed Air and Gases, Crane Safety, Electrical Safety, Eyewash Safety Showers, Laboratory Ergonomics, Lockout / Tagout, Medical Surveillance, Noise, Respiratory Protection, Reproductive Health, and Personal Protective Equipment.

Chemical Hygiene Plan

Regulatory Drivers

California's Occupational Safety and Health Administration (Cal/OSHA) Occupational Exposure to Hazardous Chemicals in Laboratories (8 CCR 5191).

Background

The University's Chemical Hygiene Plan (CHP) establishes safety requirements and guidelines for protecting laboratory personnel from potential health hazards when using hazardous chemicals in the laboratory. Additionally, the CHP is designed to comply with the regulations of California's Occupational Safety and Health Administration (Cal/OSHA) Occupational Exposure to Hazardous Chemicals in Laboratories, 8 CCR 5191. SU's "Laboratory Chemical Safety Toolkit," is a web-based companion to the CHP. It is designed to aid Principal Investigators/Laboratory Supervisors and laboratory personnel in meeting their responsibilities under the CHP and thereby ensure a safe and regulatory compliant laboratory environment. The Toolkit provides "one-stop shopping" for laboratory chemical safety. Chemical Hygiene Plan and Toolkit are intended to increase awareness of potential chemical hazards and their controls during research operations and experiments.

Program Elements

The main program components are: 1) Provision of Information and Training, 2) Consultation on Standard Operating Procedures (SOPs), 3) Exposure Assessments/Referral for Medical Monitoring, 4) Evaluation of Chemical Hygiene Plan, 5) Follow-up on Laboratory Accidents/Incidents, and 6) Development and Promulgation of Hazard Information.

Information and Training

Laboratory personnel receive information and training to ensure they are apprised of hazards of the chemicals present in their work area the provision of general and lab-specific training programs. Information and training requirements are described in section 10.2 of the University's [Chemical Hygiene Plan](#) available online.

General training. *Laboratory Chemical Safety Training* (EHS 5900) is provided as an on-line course and in a classroom



setting; it serves as the primary method of indoctrinating laboratory personnel regarding how to identify and control potential health and physical hazards associated with the use of hazardous chemicals in the laboratory environment. Classroom presentations are provided to incoming graduate students every fall within Schools of Humanities & Sciences, Engineering, and Earth Sciences. *Training for Lab Safety Coordinators*: Although the responsibility for laboratory safety rests with the Principal Investigator/Lab Supervisor, it is common that some duties are delegated to Lab Safety Coordinators, who may be staff members, post docs, or graduate students; Lab Safety Coordinator Training (EHS 5200) is designed to review some of the key tasks that such personnel may have including conducting quarterly laboratory inspections, maintaining chemical inventories, training incoming lab personnel on lab-specific equipment use, addressing questions during a regulatory inspection, etc.

Laboratory-Specific training. High Hazard Operations: For laboratories, EHS 133 is offered, which is a Tier III training. This customized, in-laboratory training is available to researchers who are conducting experiments with potentially serious life safety hazards. These experiments may involve chemicals that are highly toxic, water-reactive, extremely flammable, or explosive.

Evaluation

Evaluation of the effectiveness of the Chemical Hygiene Plan is achieved via several methodologies, including via periodic lab visits by the Safety & Compliance Assistance Program, assessments of individual lab's compliance efforts, and at the institutional level.

Annual Distribution

On an annual basis, the written Chemical Hygiene Plan and its companion document, Laboratory Chemical Safety Toolkit, is reviewed and modified, as appropriate, to address emerging issues related to laboratory safety. The CHP was substantially revised in 2007 and approved by the University Health & Safety Committee. The CHP includes provisions for managing laboratory personnel working autonomously and the requirement for prior approvals for work with "Restricted Chemicals." In 2009, a section on nanomaterials was added.

ChemTracker is queried to identify Principal Investigators with chemical inventories. The Safety and Compliance Assistance Program reviews the list for accuracy, identifying PIs who have left Stanford, or recently arrived. As of October 2011, 574 Principal Investigators are subject to the requirements of the Chemical Hygiene Plan. This list is used by IT to send a letter announcing the annual distribution of the Chemical Hygiene Plan by the Associate Vice Provost for EH&S.

Laboratory Safety Plan(s)

Chemical Toolkit. Guidance and training on the preparation of a laboratory specific chemical safety plan is provided to individual Principal Investigators and their Lab Safety Coordinators. EH&S provides a "Blue Binder" as the framework to create an individualized Lab Safety Plan. A Lab Safety Plan can also be easily assembled by following the instructions found in the Toolkit's "Introduction" section of the [Laboratory Safety Chemical Toolkit](#).

Lab Specific Training Development: To assist labs in the development of their lab-specific training programs, EH&S has developed a tool entitled, *How to Develop Lab-Specific Training* and provides consultation and support in a lab's development and implementation.

Standard Operating Procedures (SOPs)

Regulatory Drivers

8 CCR 5191(e)(3)(A), 8 CCR 5191(e)(3)(e)

Purpose

A standard operating procedure (SOP) is a set of written instructions that describes in detail how to perform a laboratory process or experiment safely and effectively. SOPs are intended to identify potential chemical and physical hazards associated with an experimental procedure and to ascribe effective engineering, work practice, and personnel protective controls to minimize or eliminate those hazards.

Guidance

EH&S provides guidance on prioritization and development Standard Operating Procedures is provided via the [Laboratory](#)

[Chemical Safety Toolkit](#). It includes a template to facilitate SOP development.

Consultation / Review

EH&S's review of SOPs is initiated two ways: (1) EH&S recommends that researchers develop an SOP in order to better understand an operation in the course of an exposure assessment, or (2) as requested by the researchers. Types of protocols reviewed include: use of antineoplastic agents in animal protocols; synthesis of nanomaterials; toxic gas operations; experiments involving highly reactive/unstable materials, particularly hazardous chemicals, and corrosives such as hydrofluoric acid. Researchers submit their draft SOP to EH&S using the template above or an equivalent. During the review process, EH&S conducts site visits of the laboratory to better understand the protocol and to check that status of certain safety equipment, such as the location of nearest eyewash safety shower, or how chemicals are transferred. The OHS staff explores with the researcher options for minimizing and controlling exposures via the use of less toxic substances, lower concentration, shorter duration and frequency. EH&S educates the researcher on the requirement for Prior Approval by his/her PI for those chemicals deemed "Restricted Chemicals" as described in section 5.0 of the Chemical Hygiene Plan. SOP development is often an iterative process between the researcher and the OHC staff member. Possible outcomes from the experimental protocol process review include additional engineering controls, proper personal protective equipment, specialized training, administrative controls and very occasionally medical monitoring and continuous environmental monitors.

Exposure Assessments / Medical Monitoring

If there is reason to believe that laboratory personnel's exposure to a hazardous substance (or physical hazard) may exceed the established exposure limit, EH&S will conduct a qualitative or quantitative assessment.

Qualitative Assessment

During review of Standard Operating Procedures and/or site visit the types, concentration, quantity, frequency, duration, and controls (including



engineering, administrative, and personal protective equipment) are assessed to determine if there is a potential for overexposures.

Quantitative Assessment

Due to laboratory-scale quantities of hazardous substances used in the research laboratory environment, and in conjunction with the use of engineering controls/personal protective equipment/work practices, monitoring (e.g., air or noise) is rarely required.

If monitoring is required, see Section II.5.b for description of Exposure Assessments. If there are spills or releases of hazardous materials, OHS assesses if the affected personnel may have sustained an overexposure and provides this information to the Occupational Health Center/SU Emergency Department for medical follow-up.

Safety and Compliance

The SCA staff are integral to the implementation efforts of the CHP via their routine visit to labs to address general laboratory safety questions regarding chemical use and storage, personal protective equipment, check compliance of self-inspection, etc. More complex issues are referred back to the CHO or other EH&S technical experts. SCA identify local and systematic issues related to laboratory safety, which inform EH&S on areas for further training and education outreach. See Section G.b.2 for additional information.

Laboratory Assessments

Background

EH&S assesses a unit's or a particular lab's efforts to implement the institutional Chemical Hygiene Plan. The focus of these evaluations is to assess the status of chemical management systems in place to ensure that key laboratory health and safety issues under the CHP are being addressed, which are: 1) Provision of hazard information and training to laboratory personnel, 2) Prior approvals and consultation, 3) Developing Standard Operating Procedures (SOPs), 4) Conducting laboratory self-inspections, and 5) Implementation of engineering controls, administrative controls, and use of Personal Protective Equipment (PPE).

Assessments involve an analysis of operations and laboratory practices with respect to current regulatory requirements and consensus standards, interviews with faculty and lab safety chiefs, walkthrough of laboratory spaces, and a review of a sampling of laboratory-specific documentation. For example, at the request of the Chair of the Chemical Engineering Department, EH&S worked directly with six selected faculty to assess the chemical management systems in place to implement the CHP in their labs. The completed project provided individual reports to each of the six faculty members and an executive summary to the department chair. This project positively impacted the department by providing: An overall assessment of the department's efforts to implement the Chemical Hygiene Plan, identifying strengths and areas for further enhancement; A culling of "best practices" on how different Chemical Engineering PIs address common EH&S challenges, which can be utilized by incoming faculty; and Findings related to facilities issues (e.g., fume hood & hazardous waste storage area needs), which are useful for programming/planning efforts, such as the new BioE/Chem E.

Institutional Level Assessment

In 2009, OHS teamed with Stanford's Internal Audit and Institutional Compliance program staff to develop an audit program specifically to evaluate the implementation of the management requirements of the Chemical Hygiene Program in laboratories on the campus. Internal Audit's evaluation of ten principal investigators' laboratories served as an assessment of management involvement at the individual faculty level, as well as of the EH&S department's efforts to administer the Chemical Hygiene Plan. The labs' ability to provide requested records and respond to oral questions demonstrated that the laboratory management (Faculty) understands their responsibilities within the Chemical Hygiene Plan, and that their laboratories have implemented appropriate safety procedures to address chemical safety management in the laboratory. At the institutional level, the audit provided validation of the administration and implementation of Stanford University's Chemical Hygiene Program. Internal Audit's report was discussed with the Stanford University Board of Trustees,

Audit and Compliance Committee on October 12, 2009.

Accidents and Incidents (follow-up)

Regulatory Drivers

8 CCR 3203(a)(6)

SU-17 Assessments

Lab personnel are to report and document all laboratory-related accidents, incidents, exposures and near misses on Stanford's SU-17 form, Incident Report, in conjunction with their supervisors. These incidents are evaluated to determine the root cause and to determine if incident poses a systemic problem. Follow-up involves phone and site visits, as appropriate, with the affected lab personnel and Principal Investigator. Consultation and training are often provided to address the root cause, such as reinforcing certain work practices or utilization of correct personal protective equipment.

Data Assessment

SU-17 data are evaluated to see any trends related to equipment problems, work practices, use of personal protective equipment, experimental design and execution, etc. Reach out and awareness educational campaigns are initiated to address any systemic issues identified.

Hazard Information

Development and Promulgation

Regulatory Drivers

8 CCR 5191(f)(E), 8 CCR 3203(a)(3)

Background

Laboratory safety fact sheets are developed to provide heightened awareness regarding the particular hazards of a class of chemicals or laboratory equipment and the appropriate controls to implement to minimize those potential hazards. The current library of fact sheets include: Air-Sensitive and highly reactive compounds, Animal research protocols involving hazardous chemicals, Autoclave Safety, Azide compounds, Biosafety Cabinet Use & Safety, Electrophoresis Safety, Hydrofluoric acid, Peroxide formers, Picric acid, Piranha solutions, Safe Operation of Shop Machinery, Shop Machinery Guidelines For Supervisors, and Warm and cold rooms: safe work practices. ChemTracker is utilized to identify labs



were a particular chemical is used, thereby facilitating promulgation of the hazard information to affected groups.

Nanomaterials

Regulatory Drivers

8 CCR 5191; California Health and Safety Code 57018-57020; NIOSH: Proposed recommended exposure limit (REL) of 7 $\mu\text{g}/\text{m}^3$ for carbon nanotubes and carbon nanofibers; 0.3 $\mu\text{g}/\text{m}^3$ for ultrafine titanium dioxide.

Background

Nanomaterials are objects with at least one external dimension in the size range from approximately 1- 100 nanometers. They are used in the pursuit of various types of basic research at Stanford, such as: medical applications involving microscopy imaging; electronic devices; energy storage devices; fuel production; and fundamental physics and materials science research.

Program Elements

The main program components are: 1) Consultation on operations involving nanomaterials, 2) Compliance with DTSC Chemical Call-in, and 3) Collaboration with Peer Institutions and the Regulatory Community on Emerging Nanotechnology Issues.

Consultation on operations

8 CCR 5191(e)(3)(A)

Guidelines entitled, General Principles and Practices for Working with Engineered Nanomaterials, were promulgated to the Stanford researchers in December 2009. These guidelines provide information on potential hazards of nanomaterials, identifies various controls to minimize potential lab exposures, and provides a specialized Standard Operating Procedure (SOP) template for research involving nanomaterials. As the scientific community continues to gather data to assess the potential health and safety risks associated with engineered nanomaterials, these guidelines may be updated. Nanomaterial safety was integrated in the Chemical Hygiene Plan and promulgated to Principal Investigators as part of the annual electronic distribution of the Chemical Hygiene Plan in October, 2010. Under the Chemical Hygiene Plan, EH&S provides consultation on experimental operations involving nanomaterials in terms of development of Stanford Operating Procedures and evaluation of the adequacy

of controls based on current prudent practices.

Compliance with DTSC

The Department of Toxic Substances Control (DTSC) has initiated two chemical call-ins in 2008 and 2010, seeking information about carbon nanotubes and various nanometals/nanometal oxides/quantum dots.

Carbon Nanotubes. As part of a chemical call-in on the use of carbon nanotubes required by the Department of Toxic Substances Control (DTSC) which was due in January 2010, EH&S identified faculty working with carbon nanotubes and other nanomaterials, such as nanometal oxides and nanometals, via an on-line survey and extensive follow-up by members of the Safety and Compliance Assistance Program. Additionally, site visits of research groups working with carbon nanotubes were conducted in order to better understand some of the challenges of working with these materials and to identify scenarios for possible monitoring and assessment. A copy of Stanford University's submission is available on the [DTSC website](#). An analysis of Stanford University's submission was provided in the [Nanotechnology Law Report](#) on January 15, 2010.

Nanometals/Nanometal Oxides. Stanford is currently under a second chemical-call for nanometals, and nanometal oxides in 2011, to be completed in December, 2011.

Collaboration with Peer Institutions

Under the leadership of Lawrence Gibbs, Associate Vice Provost of EH&S, the California Academic Laboratory Nanomaterials Working Group has been established to partner with the DTSC and NIOSH on developing an academic research laboratory guideline for safe handling and disposition of nanomaterials used in laboratories in California higher education. Representation in the working group includes faculty, graduate students, EH&S professionals, and regulators: Cal/Tech, University of California (UCLA, UCI, UCR, Office of the President), USC, the Claremont University Consortium, Stanford University, DTSC, and NIOSH. By evaluating exposures of the recommended practices, procedures and controls in conjunction with NIOSH field studies at various academic research

laboratories, the resulting guidelines will have real time data to support, or to recommend changes to, proposed laboratory procedures when working with nanomaterials. It is anticipated that, if such a set of guidelines can be developed, and evaluated for control effectiveness under real-time laboratory conditions, that academic laboratories throughout California and across the country would benefit. The group endeavors to complete the project within 2011.

Toxic Gases

Regulatory Drivers

Division B11 of the Santa Clara County Ordinance Code. The [TGO regulation](#) is available online.

Background

In September 1990, Santa Clara County adopted the Toxic Gas Ordinance (TGO) to prevent, control and respond to potentially dangerous conditions related to toxic gases and to protect the public from acute exposure due to "accidental releases" of toxic gases.

The TGO governs the storage, use and manufacturing of regulated materials in greater than specified threshold quantities. In addition, it contains specific provisions mandating engineering controls, protective equipment, storage requirements, emergency response plans, warning systems and employee training based on the type and quantity of toxic gas used. Regulated materials are defined as Class I, II, or III based on their medium Lethal Concentration (LC 50) in air, and if shipped in compressed gas cylinders/acts as a gas or per the fire code. Santa Clara County's Toxic Gas Ordinance (TGO) establishes three levels of regulation regarding laboratory use of toxic gases:

1. **Full TGO Compliance:** Materials whose quantities and duration of use require operation within the full TGO and Uniform Fire Code (UFC). A permit and specific controls are required for operations involving Class I, Class II and Class III regulated materials. At Stanford University, permitted operations occur in Paul Allen Center for Integrated Systems, Stauffer I, and Stauffer II. For permitted operations, the Safety & Compliance Assistance (SCA) Program accompanies inspectors during inspections for toxic gas



storage and during annual toxic gas sensor maintenance evaluations. During 2010, Facilities Operations led a project to remove 77 toxic gas sensors from the Lokey, Moore, McCullough, HTGL and MERL buildings because the level of research reduced or did not materialize that warranted fully permitted facilities with sensors. Rather, research drivers changed, with exempt quantities or non-regulated concentrations of toxic gases meeting the research needs of the Principal Investigators. The infrastructure for the toxic gas sensor systems remain in place, should research necessitates activation, at which point EH&S would assist the departments from obtaining the necessary Santa Clara County Toxic Gas permits. Facilities Operations reported that the removal of these toxic gas sensors will save the University ~\$50,000.

2. **TGO Limited-Use Laboratory:** Limited to laboratory and research experiments, which meet the TGO Standards for use of small quantities of gas in research for limited period of time (30 consecutive days). A notification and approval from the county is required, along with the implementation of specific controls. Currently, there are none of these operations on campus.
3. **Exempt Quantities:** A regulated material is exempt from most of the provisions of the TGO if: Flow-limiting devices and fire-extinguishing systems are required for Class I materials, regardless if exempt quantity is used. Also, exempt quantity operations must meet all other hazardous materials handling policies and regulations. Numerous research projects involving exempt quantities, which are not subject to many provisions of the TGO, are performed in other laboratory facilities such as Lokey, Moore, and 02-570.
4. **Non-regulated Materials:** Operations involving non-regulated must meet all other handling policies and regulations. Stanford University's [Toxic Gas Table](#) is used to determine when a toxic gas drops out as a regulated material due to its concentration.

The OHS Group, in conjunction with the Fire Marshal's Office and Environmental Programs, supports this program area as follows:

The main program components are: 1) Consultation on Experimental Protocols, 2) TGO Compliance Inspections, 3) Plans Review, and 4) Development and Promulgation of Program Tools/Information.

Experimental Protocol Review

8 CCR 5191(e)(3)(A)

At Stanford University, the use of toxic gases requires prior approval by the Principal Investigators as they are defined as "Restricted Chemicals" under the institutional Chemical Hygiene Plan ([http://chemtoolkit.stanford.edu/Restricted Chem](http://chemtoolkit.stanford.edu/RestrictedChem)). During these reviews, EH&S works with researchers to determine if toxic gas concentrations and/or amounts can be reduced to below regulatory limits in order to minimize potential health and safety hazards, as well as reduce regulatory burdens associated with permitted operations. These assessments check that that health and safety controls toxic gas use are included, as well as compliance issues (e.g., storage, labeling, inventory and HMMP reporting of toxic gases).

TGO Compliance Inspections

Santa Clara Ordinance Section B11-301

Santa Clara County Hazardous Material Control Division conducts inspections for compliance of permitted facilities on an annual basis to check performance of toxic gas sensors, storage, and records. The Safety & Compliance Assistance Program staff attend these inspections; see Section G.b.2 for program description.

Plan Reviews

EH&S provide reviews plans consultation for new construction and renovation projects involving toxic gas use. See Section E.b.7 for program description.

Information and Tools

EH&S's website provides an numerous guidance documents to assist researchers considering the use toxic gases, which are updated and maintained by the OHS group in conjunction with SUFMO, including: Stanford University - Required Actions for Regulated, Exempt, and Non-regulated Toxic Gas Operations; Stanford University's TGO Table; Stanford University: What Researchers Need to Do

In Preparation for Operations Involving Exempt Quantities of Toxic Gas; Stanford University Chemical Hygiene Plan - Prior Approval Requirement for Use of Toxic Gases; Stanford Toxic Gas Alarm Systems; Stanford University Toxic Gas System Maintenance Responsibility; Guidelines: Fire and Gas Emergency Monitoring Operational Matrix; Stanford University Compressed Gas Leak Test Procedure; and Restricted Flow Orifices.

Controlled Substances

and Precursor Chemicals

Regulatory Drivers

Code of Federal Regulations (CFR) 1300; California Health & Safety Code 11100.

Background

Controlled Substances

Controlled substances are chemicals which are strictly regulated by the Federal Drug Enforcement Administration (DEA) due to their potential for illicit abuse. They are categorized by "Schedules" one through five, according to their potential for abuse. Examples include: Schedule I (Marijuana, Heroin, LSD), Schedule II (Fentanyl, Pentobarbital, Cocaine), Schedule III (Beuthanasia, Buprenorphine, Ketamine), Schedule IV (Diazepam, Alprazolam), and Schedule V (Codeine preparations). At Stanford University, Controlled Substances are used in forty departments, primarily in the School of Medicine, and are predominately used in the support of animal research.

Precursor Chemicals: The mission of the DEA's and the CA-DOJ's Precursor Chemicals Control Programs are to disrupt the illicit production of controlled substances by preventing diversion of chemicals used to make drugs. The illegal production of drugs such as methamphetamine, cocaine, heroin, and MDMA (ecstasy) requires enormous quantities of precursor and essential chemicals. These federal and state programs seek to minimize the regulatory burden on the legitimate chemical industry while instituting effective anti-diversion policies. At Stanford University, precursor chemicals are used in twenty departments (predominately Chemistry, Chemical Engineering, Bioengineering, Biochemistry, and Material Science) and



are used for synthesis and other experimental procedures.

Program Elements

Principal Investigator (PI) Enrollment

Review/Approval of Submissions (CFR 1301.90-93)

Enrolling faculty under the institutional research registration involves the following steps: 1) Review of CSP Form 1, SU Controlled Substance Purchase Request Application, for completeness. This is the form that indicates the name of the

Start-up Lab Inspection: ((CFR 1301.71, 1301.75, CFR 1304.04)

EH&S staff meet with the faculty and his/her lab manager to whom some of the program duties are delegated to review the key responsibilities in the correct management of controlled substances, including security and recordkeeping requirements. The proposed storage location is inspected and approved A copy of SU's Controlled Substances Binder is provided to facilitate correct recordkeeping.

Ordering / Dispensing / Disposal (CFR 1304.21-22, 1305.05, 1305.07,

registration. Packages are logged into the Controlled Substances Receiving Log, and stored in the safe until pick up by the PIs authorized researcher. Authorized researchers pick up packages from EH&S, completing chain-of-custody paperwork, and then return the package directly to the approved storage location with their lab. Authorized researchers record each dispensation on CSP Form 3, SU Controlled Substances Log. EH&S's Hazardous Waste Group, picks up expired or unused Controlled Substances from the lab after receipt of CSP Form 6, SU Controlled Substance Disposal Form. EH&S coordinates with an approved Reverse Distributor to dispose of controlled substances waste.

Periodic Inspections (8 CCR 3203(a)(4))

EH&S sends out quarterly reminder to enrolled faculty to conduct self-inspections of controlled substances management and stock using CSP Form 7, SU Controlled Substance Periodic Inspection Checklist. To assist in overall programmatic compliance, EH&S conducts periodic inspections of labs with potentially greater regulatory risk (e.g., labs using Schedule II drugs, labs with greater than 10 authorized researchers). EH&S collaborates closely with the Administrative Panel on Laboratory Animal Care (APLAC) on matters related to the veterinary use of Controlled Substances to ensure compliance related to both animal welfare and DEA regulations.

Biennial Inventory (CFR 1304.11(c))

In January of odd numbered years, EH&S conducts the University's biennial controlled substances inventory, a one-day regulatory requirement to account for all controlled substances acquired under the institutional registration. In preparation for this event, EH&S promulgates announcements and prepares tailored inventory sheets to facilitate high compliance; this methodology resulted in outcomes with 100% compliance during the 2007, 2009, and 2011 inventory events, where both lab and EH&S staff resources were utilized efficiently. These efforts help to ensure the University's institutional research registration with the Federal Drug Enforcement Administration.

Training / Program Aids

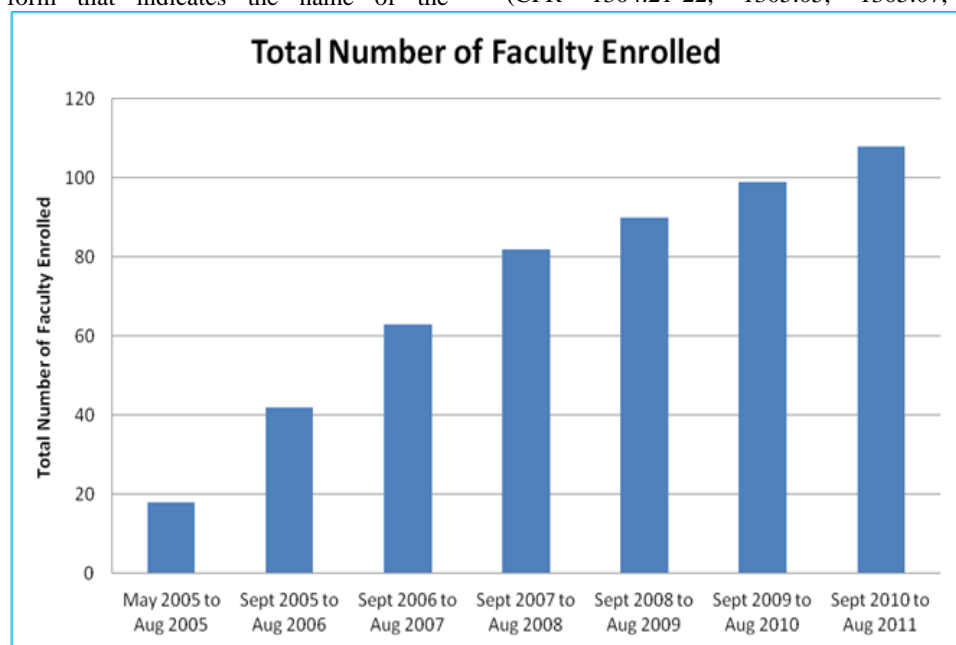


Figure 3 Faculty Enrolled in Controlled Substances Program

protocol for which the controlled substances will be used, and the personnel the PI will authorize to work with the controlled substances. PI's provide an account number on which to order the controlled substances; EH&S facilities journal transfers. Evaluation of APLAC/IRB protocol to verify the specific types of controlled substances authorized for the research; or review of experimental protocol with approval by the Department Chair. EH&S reviews and maintains CSP Form 2, SU Controlled Substance Authorized Researcher Application, for each authorized person This form is where the authorized research declares that he/she has not been convicted a drug felony and will report suspect drug diversions.

1305.12)) Strict chain of custody is required to track each container of controlled substances ordered under the institutional registration from cradle to grave. Program records are maintained under lock and key in the Controlled Substances Program office and in the Hazardous Waste Program office. EH&S staff, to whom Power of Attorney has been granted by the Vice Provost of EH&S, uses the DEA registration to order Schedule II-V controlled substances from approved veterinary and chemical suppliers, as well as the Stanford University Hospital Pharmacy. For Schedule II controlled substances, a DEA form 222 is prepared. Controlled Substances packages are delivered to EH&S, the address of the institutional



The start-up lab inspection serves as a one-on-one training with the faculty to orient him/her on the key management responsibilities of the program. To facilitate compliance and understanding of programmatic and regulatory requirements of Controlled Substances, EH&S provides classroom training and is in process of creating a web-based training. EH&S maintains a host of program job aids on the EH&S website, including [flow charts and FAQs](#) to facilitate understanding, for both enrolled faculty and faculty administering individual registrations available online.

Registration Renewal (DEA 222 Forms)

(CFR 1305.11, 1309.11)

EH&S submits an electronic renewal for the institutional research registration on an annual basis. Currently, the renewal fee \$184.00, which EH&S administers. By having the institutional registration, individual PIs are saved this cost. EH&S maintains a supply of DEA 222 forms, which are required for Schedule II Controlled Substances purchases.

DEA Interface

(CFR Proposed Rule 2003)

EH&S interfaces with the DEA on matters of interpretation, enrollment of faculty with uses of new Schedule II controlled substances, reporting of losses or left, and inspections.

Precursor Chemicals

(CFR 1310.2, CA Health & Safety Code 11100)

Principal Investigators submit Form 5, Chemical Precursor Purchase Request Application to EH&S. In signing this form, the Principal Investigator certifies that the intended research with the precursor chemical is legitimate and necessary. EH&S uses the institutional DEA registration to order DEA List Chemicals and California Precursor Chemicals.

Continued Growth

The Controlled Substances Program continues to enroll new PIs and support participating PIs (refer to Figure 3). There are currently, 108 faculty enrolled. These PIs have designated their researcher staff as authorized researchers. With approximately 630 researchers now working with controlled, on-going vigilance in correct storage, security, and

recordkeeping is critical so as to not jeopardize the institutional registration.

DEA Inspection

On April 20, 2010 the Federal Drug Enforcement Agency paid courtesy visit to EH&S to inform the University that they will commence unannounced compliance inspections of laboratories enrolled under the institutional DEA registration to assure that proper security of controlled substances and recordkeeping are in place. EH&S alerted the enrolled faculty of these pending inspections and emphasized the need for ongoing vigilance in proper security and recordkeeping.

Regulatory Changes

H.R. 1254, the Synthetic Drug Control Act, would place several chemical compounds in the Schedule I, which requires faculty to independently apply and manage an individual research registration. Schedule I drugs or substances have a high potential for abuse. They have no currently accepted medical use in treatment in the United States, and there is a lack of accepted safety for use of the drug or other substance under medical supervision. Examples of Schedule I substances include mescaline, marijuana, heroin, lysergic acid diethylamide (LSD), marijuana, and methaqualone. If enacted, faculty will incur additional management and cost burdens with the acquisitions and management of such substances.

Select Agents and Toxins

Regulatory Drivers

42 CFR Part 73

Background

Initiated in 1996 with the [Antiterrorism and Effective Death Penalty Act](#) (1996), and bolstered by the [USA Patriot Act](#) (2001), and the [Public Health Security and Bioterrorism Preparedness and Response Act](#) (2002), the National Select Agent Registry (NSAR) Program oversees the transfer, possession, and use of biological agents (viruses, bacteria) and toxins that have the potential to be a severe threat to public or environmental health. Possession of the specified agents or toxins without registration carries severe civil and criminal penalties. Possession of Select Agents or Toxins over exempt amounts is not allowed at Stanford at this time and would require prior approval from the Vice

Provost and Dean of Research and registration with the NSAR Program.

Below is the list of Select Toxins and the maximum amounts allowed to qualify for the exemption:

Toxin	Maximum allowable per PI
Abrin	100mg
Botulinum neurotoxins	0.5mg
Clostridium perfringens epsilon toxin	100mg
Conotoxins	100mg
Diacetoxyscirpenol	1000mg
Ricin	100mg
Saxitoxin	100mg
Shigatoxin and Shiga-like ribosome inactivating proteins	100mg
Staphylococcal enterotoxins	5mg
Tetrodotoxin	100mg
T-2 toxin	1000mg

Program Elements

Exempt quantities of select agent toxins are used in various research labs throughout campus. To ensure inventory, security and general health and safety associated with the use of exempt quantities of select agent toxins, the OHS Program provides the following services:

Inventory Screening

On a monthly basis, ChemTracker is queried for Select Agent Toxin record to find new users and to ensure they receive program documentation. As of October, 2011 there are 29 labs working with exempt quantities of select agent toxins.

Quarterly Self-Inspections

Faculty enrolled working with exempt quantities of select agent toxins use EH&S's Select Agent Toxin Program checklist, which validates the inventory quantities are exempt, storage and physical security measures are in place.

Laboratory Visits

Approximately once per year, each lab using exempt quantities of select agent toxin are visited to evaluate compliance with the elements within the Quarterly Self-Inspections.

Regulatory Changes

The Act requires biennial review and republication of the select agent and toxin list; changes are monitored. For example, proposed changes were issued in July, 2011 that may affect security, training,



biosafety/biocontainment, and incident response for registered facilities.

Laboratory Ventilation

Engineering Controls

Regulatory Drivers

Ventilation Requirements for Laboratory-Type Hood Operations (8 CCR 5154.1), General Requirements of Mechanical Ventilation System (8 CCR 5143), Santa Clara County Toxic Gas Ordinance, Section B11- 384(b), and Fire Code, 2007 California Fire Code: 2703.8.6 and 3704.1.2.

Background

General Exhaust Ventilation (GEV).

Laboratories at Stanford are designed with nonrecirculating ventilation systems that provide 6 air changes per hour.

Local Exhaust Ventilation (LEV).

In addition to general exhaust ventilation, a variety of local exhaust ventilation is used to remove contaminants at the source in the laboratory environment. The purpose of such devices is to control harmful exposures to hazardous substances. Cal/OSHA defines a hazardous substance as one which by reason of being explosive, flammable, poisonous, an irritant, or otherwise harmful is likely to cause injury or illness. Examples of LEV's include: *Laboratory-Type Fume Hood* (a device enclosed except for necessary exhaust purposes on three sides and top and bottom, designed to draw air inward by means of mechanical ventilation, operated with insertion of only the hands and arms of the user and used to contain hazardous substances); *Gas cabinets* (ventilated enclosures that are used to isolate hazardous gas cylinders from the surrounding work place); *Wet benches* (either acid wet benches or solvent wet benches, are ventilated devices in which users manipulate items in and out of chemical baths/rinses); Powder-handling enclosures (exhausted enclosures that operate at low velocities to minimize turbulence when handling powders such as antineoplastic agents and nanomaterials); *Down draft tables* (draw fugitive emissions away from the breathing zone of workers during necropsy and anatomy work); and *Snorkel trunks* (used to exhaust local laboratory operations (e.g., over spin coaters)).

Program Elements

The main program components are: 1) Development of Performance and Certification Criterion, 2) Response to Malfunctioning Equipment, and 3) Interface with Facilities Operations and Project Management.

Certification and Performance Criterion

(8 CCR 5143(a)(5))

EH&S develops certification and performance criterion for ventilation controls used in laboratories, such as [laboratory-type fume hoods](#) and [toxic gas cabinets](#), which are available online. These procedures are based on regulatory requirements, consensus standards, industry best practices, and manufacturer's recommendations.

Malfunctioning Equipment

(8 CCR 3203(a)(6), 8 CCR 5155)

Maintenance. Engineering controls and equipment must function properly at all times in order to protect the health and safety of laboratory employees. Maintenance work is either provided by the University's Heating Ventilation Air Conditioning Shop or by the manufacturer of the specific equipment. Laboratory hoods and gas cabinets are tested according to the schedule described in the [Chemtoolkit](#). **Coordination with Labs:** EH&S interfaces with Facilities Operations and building management when laboratory fume hoods and other lab equipment malfunction, such that laboratory personnel are notified to cease work until repaired.

Exposure Concerns: Evaluate potential exposure concerns to hazardous substances resulting from malfunctioning equipment. See Section II.5.b for description of exposure assessments.

Interface with Facilities Operations and Project Management

(8 CCR 5154.1(c))

Regulations: EH&S monitors and advises the University on regulatory changes affect ventilation issues (e.g., use of alternative tracer gases for ASHRAE-110 testing for laboratory-type hoods with reduced face velocity capabilities when not occupied).

Energy Conservation Initiatives: EH&S collaborates with university Utilities group on campus energy conservation and sustainability efforts. **Special Requests:** EH&S evaluates requests for certain types

of equipment (e.g., ductless fumehoods) to determine adequacy for exposure control.

Laboratory Plan Review

Regulatory Drivers

There are numerous regulations and consensus standards that impact and inform the laboratory design and construction process. Regulations include: Federal Labor Standards (29 CFR), Cal/OSHA Standards (8 CCR), Uniform Fire Code (24 CFR Part 9), Uniform Building Code (24 CFR Part 2), CDC Select Agents (Title 42, Chapter I, Part 72), NFPA Handbook 70, National Electric Code, California Radiation Control Regulations, Palo Alto Municipal Code (Title 16), County of Santa Clara Toxic Gas (Ordinance NS-517.44). Consensus Standards and References include: American National Standard for Laboratory Ventilation (ANSI/AIHA Z9.5-1992), American National Standard for Emergency Eyewash & Shower Equipment (ANSI/AIHA Z385.1), American National Standard for Thermal Environmental Conditions for Human Occupancy (ANSI/ASHRAE 55-1992), State of California, Department of Health Services, Radiologic Health Branch / Guide for the Preparation of Applications for Medical Programs (RH 2010 4/90) (not formally adopted), "Safe Handling of Radioactive Materials", National Council on Radiation Protection (NBS Handbook 92), "Safe Handling of Radionuclides", International Atomic Energy Agency, Safety Series No. 1 / (1973 ed. is still current as of 1999) (IAEA), CDC-NIH Biosafety in Microbiological and Biomedical Laboratories, 3rd Edition, Guidelines for Research Involving Recombinant DNA Molecules (NIH Guidelines), January 1997, and Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide, Federal Emergency Management Agency: FEMA-74, 1994

Background

To support the research mission of the University, careful plans review of new laboratories buildings and laboratory renovations is essential. Poorly designed laboratories can potentially affect the health & safety of laboratory personnel, create potential regulatory and liability risks to the University, and fail to meet the scientific research needs of the Principal Investigator.



Program Elements

The main program components are: 1) Plan Review, and 2) Management of EH&S's Laboratory Standards & Design Guide.

Plan Reviews

Incoming Plans: EH&S's SUFMO office manages all the incoming plans from Lands and Buildings for both new construction and renovation, and distributes an updated listed of projects on approximately weekly basis so that the different disciplines within EH&S can review plans for their respective program areas. **Blue Print Review:** Blue prints for each construction project is checked for compliance with Cal/OSHA regulations and ANSI and ASHRAE consensus standards, including building ventilation, fume hoods, special purpose hoods, emergency eyewash and safety showers, ergonomic issues, roof safety, etc. **Toxic Gas Operations:** If a project involves toxic gas operations, OHS partners with SUFMO in the review process regarding requirement for gas sensors. SUFMO overseeing other key necessary infrastructure such as alarms, piping systems, etc. in order to fulfill the requirements of Santa Clara County's Toxic Gas Ordinance; permits are obtained for fully permitted operations. **Energy Conservation Considerations:** Some of these projects integrated green building concepts, which include lower air change rates, natural ventilation, open lab layouts, and as a result, the OHS group faced some new review challenges. With energy conservation a paramount design consideration today, we expect to see more building designs that compete with current established laboratory ventilation. **Consultation/Site Visits:** To facilitate understanding of the proposed programming of the space, OHS staff collaborates closely with SUFMO staff who attend construction meeting, and as needed, obtains clarification from the faculty member on the projected laboratory activities and conducts site visits. **Documentation:** Comments are provided to SUFMO for inclusion in their submittal to the project manager. **Iterative Review:** Plans review is an iterative process, with a single new building or renovation undergoing checks at various stages in the project (e.g., at schematic design through construction set).

Laboratory Standards & Design Guide

The OHS Group has prepared EH&S [Laboratory Standards & Design Guide](#) to aid the campus community with planning and design issues of laboratories, which is available online. The Laboratory Standards & Design Guide, in conjunction with EH&S's plan review and consultation, improves design efficiency and minimizes costly post-construction changes. This document is modified to keep pace with changing regulatory requirements and industry standards. OHS is the custodian of this document and collaborates with other EH&S disciplines, as well as Lands & Buildings, as needed to update.

University Policies

Related to Laboratory Safety

Regulatory Drivers

State Of California Department of Industrial Relations, Division of Labor Standards (Child Labor Laws 2000), [Administrative Guide](#): Minors (Section 2.f).

Background

EH&S partners with Risk Management, Employee and Labor Relations, and the Legal Office in the preparation and promulgation of information affecting laboratories, such as the, [Health and Safety Requirement for Minors in Laboratories at Stanford University](#), which is available online.

Future Needs / Challenges

Continued Promotion of a "Culture of Laboratory Safety"

Over the past couple of years, a number of high profile and tragic accidents in academic research laboratories has led to increased scrutiny and a perception that academic research organizations are lax in their attitude toward safety in research laboratories (e.g., [UCLA](#), [Texas Tech University](#)). Recently, the United States Chemical Safety Board completed an investigation of the Texas Tech laboratory incident involving serious injury to a graduate student and has made recommendations that faculty and others in leadership positions at academic research institutions reinforce the need for more

focused attention on laboratory safety, especially in graduate research laboratories. The basic recommendation is that every research laboratory should ensure they have good, specific laboratory safety plans in place and that all persons in their respective laboratories have been appropriately trained to identify and understand the risk and hazards of the materials being used and to follow appropriate safety procedures for the type of research work being conducted in the laboratory. These accidents highlight the need to continue our efforts, moving along a continuum, to inculcate a "culture of safety" in the day-to-day practices within our Stanford laboratories, whereby the pursuit of research goals and knowledge is achieved congruently with the adherence to sound health and safety practices. This is an on-going effort due to the large number of affected personnel; 574 faculty are subject to the University's Chemical Hygiene Plan along with approximately 4500 laboratory personnel, including, staff, undergraduate student, graduate students, postdoctoral fellows, and visiting scholars, of which there is high turnover. Promulgation and implementation of laboratory safety efforts will target each laboratory in preparing a Lab Safety Plan. Individual Lab Safety Plans includes documentation of key laboratory records and processes such as training records, standard operating procedures, and lab-self inspection records.

Increased regulatory focus in laboratories

Increased inspection by the California Division of Occupational Health & Safety (Cal/OSHA) is anticipated due to the following:

[Outcome of UCLA Laboratory Accident](#). s the result of a tragic laboratory accident that resulted in severe burns and subsequent death of a young researcher at UCLA in 2009, EH&S expects that Cal/OSHA will focus more inspection on health and safety compliance in University research laboratories, particularly on the correct and consistent use of Personal Protective Equipment, establishment of hazard-based Standard Operating Procedures, and provision of laboratory-specific training. Therefore, in the electronic annual distribution of the Chemical Hygiene Plan in October 2010 and reiterated in 2011, Principle



STANFORD UNIVERSITY

Investigators were advised to: Increase vigilance on ensuring the correct and consistent use of appropriate laboratory [Personnel Protective Equipment](#) by all personnel and at all times while in the laboratory; Continue to move forward on the prioritization and development of [Standard Operating Procedures](#) (SOPs), as they can affect health and safety in the laboratory, as well as meeting regulatory requirements; and Ensure that all researchers receive [training](#) on the specific hazards that may exist in your lab and the procedures, equipment, and resources available in the laboratory for working safety around these hazards.

Projects Receiving Stimulus Funding: EH&S has been notified by the California Division of Occupational Health and Safety (Cal/OSHA) that they will be conducting inspections of projects at Stanford that have received funding from the American Recovery & Reinvestment Act (ARRA). Although Cal/OSHA will only be inspecting a small sampling of the projects receiving ARRA funding, faculty were advised on August 20, 2010 to be aware of the increased likelihood of inspection. For research laboratories, this primarily means ensuring that the University's Chemical Hygiene Plan and Injury & Illness Prevention Program have been fully implemented. To date, these inspections have not yet occurred, but are anticipated.

Institutional Inspection by the DEA

With 108 enrolled faculty and nearly 650 researchers now working with controlled substances on the main campus, on-going vigilance in correct storage, security, and recordkeeping is critical so as to not jeopardize the institutional registration. On April 20, 2010 the Federal Drug Enforcement Agency paid courtesy visit to EH&S to inform the University that they will commence unannounced compliance inspections of laboratories enrolled under the institutional DEA registration to assure that proper security of controlled substances and recordkeeping are in place. EH&S alerted the enrolled faculty of these pending inspections and emphasized the need for ongoing vigilance in proper security and recordkeeping. While these unannounced inspections have not yet begun due to reported staffing shortages at the agency, we anticipate that they will involve significant EH&S staff and researcher resources to participate in the expected documentation review and site inspections.

Support of Nanomaterials Research

The OHS Program anticipates providing increasing support for research in this emerging area of science involving nano-materials and structures. Given that the health and safety impacts of nano-materials are not yet well-understood, OHS staff will be increasingly relied upon to advise researchers on prudent practices appropriate for conducting experimental activities within research facilities such as the Stanford Nanofabrication Facility at the

Center for Integrated Systems (CIS), and the SEQ2 Nano-Center. The introduction of nano particles in animal-related work will require controls to minimize potential exposures. Also, rule-making by Cal/EPA is likely, and therefore the close collaboration with the DTSC is essential in order to influence this potential rule making such that it addresses the laboratory-scale use of nanomaterials in academic research settings.

Expanding laboratory environment

With the increase in the number of laboratories and the trend toward multidisciplinary areas of research coupled with the ongoing turnover of laboratory personnel (e.g., graduate students and post doctoral fellows) widespread implementation of the institutional Chemical Hygiene Plan (CHP) will require a long-term commitment. This involves working closely with Principal Investigators and their staff to integrate key elements into day-to-day lab procedures. With the annual promulgation of online Laboratory Chemical Safety Toolkit, a companion to the CHP, increased awareness among laboratory personnel to prepare Standard Operation Procedures is expected to rise and subsequent requests for EH&S reviews are anticipated. Targeted educational companions around higher risk chemicals and operations is a priority.

Safety and Compliance Assistance Program

Purpose	Assist laboratories and shops with hazardous materials and waste management (e.g., storage, handling, and disposal); serve as point-of-contact for EH&S issues; and reduce duplication of EH&S efforts.
Program Elements	Regulatory Agency Inspections Safety and Compliance Site Visits Health Physics Program Support Training Laboratory Safety Program Support Specialized Support Services to the Department of Chemistry Laboratory Moves (assistance) Special Projects
Business Drivers	<ul style="list-style-type: none"> Department of Toxic Substances Control (DTSC) citations Regulatory inspections Hazardous materials research

Program Genesis

In 1994, Stanford University paid \$995,000 to settle outstanding citations with the State of California Department of Toxic Substances Control, primarily for laboratory waste handling and management problems and errors in completing required labels and other

administrative requirements. The Compliance Assistance Program was created the same year to assist operating areas with hazardous wastes to understand and comply with State and County requirements for hazardous waste management. Since 1994, the program has evolved significantly and currently

provides varying levels of support to all EH&S technical programs. In 2010, the program was renamed the Safety & Compliance Assistance Program to better reflect the program's safety-related services that go beyond compliance.

Summary



STANFORD UNIVERSITY

The Safety & Compliance Assistance (SCA) Program serves the University by directly working in the field with laboratories and shops on issues relating to the storage, handling, and disposal of hazardous materials and waste. The program is staffed by four 1.0 FTE health and safety specialists and one 1.0 FTE supervisor. SCA currently provides assistance and support to approximately 2500 laboratory and shop spaces on campus. SCA also functions as an in-the-field liaison for all other EH&S technical programs.

The goals of the SCA program are to: Provide assistance to all University locations on and off campus with hazardous materials and hazardous wastes in developing a laboratory or shop management system that supports safety and maintains regulatory compliance with hazardous waste disposal, hazardous materials storage, basic fire safety, chemical hygiene, biosafety requirements, and waste water discharges; Serve as a liaison and single point of contact for operating area personnel on EH&S issues and inquiries. SCA also provides a route for quickly and effectively disseminating EH&S information to operating area personnel; and Enable EH&S to maximize departmental resources by reducing duplication of efforts from program to program and allowing EH&S specialists to dedicate their efforts to specialized and non-routine issues. SCA staff are assigned specific buildings and departments to support in order to gain familiarity with area personnel, operating methods, and the physical sites in their coverage areas. Due to their role as in-the-field generalists with specialized knowledge of their coverage areas, SCA staff are able to quickly mobilize for campus-wide followup and response, e.g., after the 2009 *UCLA tert-butyllithium* fire fatality and this year's Yale University shop fatality.

Program Elements

Regulatory Agency Inspections

Regulatory Driver

This program element is driven by the State of California Health and Safety Code Section 25185 and County of Santa Clara Ordinance Section B11-4.

Background

SCA functions as the University's representative during inspections by regulatory agencies covering hazardous materials, hazardous waste, toxic gases, waste water, medical waste, and underground and aboveground storage tanks. Routine inspections are typically performed annually or biennially by the following regulatory agencies: Santa Clara County Hazardous Material Control Division, Santa Clara County Medical Waste Management Program, City of Palo Alto Fire Prevention Bureau, City of Palo Alto Environmental Compliance Division for the Regional Water Quality Control Plant (Note: Stanford Utilities takes the lead for waste water inspections including responding to findings), and Other agencies, such as the State of California Department of Toxic Substances Control and the Environmental Protection Agency, also perform inspections but do not have a regular inspection frequency

Program Elements

SCA accompanies external regulatory agencies on inspections to ensure that: As many questions and issues identified by inspectors are resolved during the inspection as possible to avoid findings being cited; Inspectors apply consistent interpretations of regulatory requirements; SCA staff use the same interpretations during training and safety and compliance surveys; and New requirements and interpretations are quickly disseminated to area personnel. In the post-inspection process, SCA assists local units in correcting findings and prepares written notifications to regulatory agencies about corrective actions that have been taken. SCA maintains copies of inspection reports, documentation of corrective actions, and written responses to agencies on any issues raised during those inspections. Note: The School of Medicine Health and Safety Office takes the lead on responding to regulatory agency findings for all School of Medicine buildings.

Site Visits

Regulatory Driver

This program element is driven by the State of California Code of Regulations Title 8, Section 3203 and County of Santa Clara Ordinance Section B11-301.

Background

SCA staff conduct scheduled and unscheduled visits to laboratories and shops to assess regulatory compliance in the following areas: Hazardous chemical and waste storage, Compressed gas and cryogenic liquid storage, Toxic gas storage, Biohazardous material signage and disposal, Chemical Hygiene Plan implementation, Basic fire safety, and Life Safety Box updates.

Program Elements

Identify potential safety and compliance issues and provide guidance on the corrective actions needed. Locations that may receive priority focus include areas identified by SCA staff as having repeat issues, new laboratories that are setting up (i.e., new principal investigators), and laboratories that have recently moved to new locations either within the current building or to a new building. Assess how effectively area personnel are conducting required quarterly self-inspections for laboratory and shop locations by evaluating their compliance with the laboratory and shop self-inspection checklists. Note: Monthly self-inspections are required for chemical storage areas that are not routinely occupied by area personnel. Prepare laboratories and shops for announced or anticipated regulatory agency inspections and fire inspections by the Stanford University Fire Marshal's Office. Work directly with area personnel to correct deficiencies through on-the-spot training, guidance and recommendations, and, if necessary, followup with the principal investigator/supervisor. Questions and concerns about operating areas and/or area personnel are communicated to the appropriate EH&S technical program for follow up as needed.

Health Physics Program Support

Radiation Safety Surveys

Regulatory Driver

This program element is driven by the Code of Federal Regulations Title 10, the State of California Code of Regulations Title 17, and the University's radioactive materials license. See the Health Physics Program section for additional details.

Background



Currently, about 20% of the total work time within the SCA Program is spent conducting radiation safety surveys in support of the Health Physics Program. Over the last decade, the number of radiation surveys conducted by SCA has decreased an average of 4% per year (Note: This average includes a 4.6% increase in the number of surveys between 2008 to 2010). The overall decrease in the last decade is the result of the general trend towards a reduction in the number of research laboratories using radioisotopes on campus. The types of radiation safety surveys conducted are: Routine: For rooms with current radioisotope usage and/or storage, Terminal: For rooms that plan to cease radioisotope usage and storage, and Equipment: For equipment used for radioactive work which the lab plans to dispose of or relocate.

Program Elements

Measure radiation and contamination levels of equipment and laboratory work areas including taking physical swipe samples; Identify non-compliant radioactive material work practices in these locations and notify appropriate area personnel for correction and/or refer the issue to the Health Physics Program for followup; Process and evaluate survey swipe samples for radioactive contamination. If contamination is identified, SCA conducts immediate followup with the laboratory on decontamination procedures and requirements. SCA holds all survey printout records for one year; and Notify the Health Physics Program about all contamination and work practice issues in the surveyed areas.

Calibration of Radiation Survey meters

Regulatory Driver

See the Health Physics Program section for additional details.

Background

All meters used to measure radiation exposure levels or contamination must be calibrated at least annually.

Program Elements

SCA picks up and returns more than 200 meters to laboratories each year for the

Health Physics Program. The majority of instruments are calibrated by a student employed by the Health Physics Program with SCA staff as backup. Meters are calibrated against National Institute of Standards and Technology (NIST) traceable sources in the calibration range at the Environmental Safety Facility using a variety of sources to ensure that the instruments operate correctly. Instruments are calibrated at two points on each range to within 10% of correct readings with accompanying correction charts or graphs. Calibration results are documented, furnished to projects, and the hard copies filed.

Training

Regulatory Driver

This program element is driven by the State of California Code of Regulations Title 8, Section 3203.

Background

SCA provides ongoing classroom and one-on-one training to area personnel as an integral component of EH&S safety training goals. Classroom trainings are provided to a group of attendees and typically include a prepared presentation, hand-out materials, and a question and answer period. One-on-one trainings are intended to provide information or guidance to area personnel on specific safety and compliance issues or topics.

Program Elements

Examples of classroom training provided by SCA include: *Annual departmental safety orientations* for incoming graduate students to present material equivalent to the online safety courses General Safety and Emergency Preparedness (EHS-4200), Chemical Safety for Laboratories (EHS-1900), and Compressed Gas Safety (EHS-2200); *Departmental meetings* for lab safety coordinators to provide notification about specific departmental safety and compliance issues or to disseminate new EH&S guidance or policies; and *Laboratory group meetings* to followup on lab-specific safety and compliance issues. Examples of one-on-one training provided by SCA include: *Follow-up* with appropriate lab personnel on items noted during a site visit of a laboratory or shop; *New principal investigator orientations* to explain how safety and compliance are managed at the University and to review Chemical Hygiene Plan requirements;

Orientation for *Lab Safety Coordinators* (EHS-5200). This training may also be provided in classroom format; and *New user training* on ChemTracker and the online Chemical Waste Manager applications. This training may also be provided in classroom format.

Laboratory Safety Program Support

Chemical Hygiene Plan compliance

Regulatory Driver

This program element is driven by the State of California Code of Regulations Title 8, Section 5191 and the State of California Code of Regulations Title 8, Section 3203.

Background

SCA provides assistance to the Laboratory Safety Program's efforts to ensure compliance with the institutional Chemical Hygiene Plan. This increased support to laboratory safety efforts reflects a trend towards a more risk-based approach to laboratory safety rather than a compliance-based focus.

Program Elements

SCA assists laboratories with the evaluation of laboratory operations, investigation of incidents and accidents, and development of standard operating procedures and lab-specific training.

Controlled Substances and Precursor Chemicals Program Support

Regulatory Driver

See the Controlled Substances and Precursor Chemicals Program section for additional details.

Background

SCA staff function as primary backup support for the Controlled Substances and Precursor Chemicals Program.

Program Elements

Conduct start-up inspections, order and receive drugs and precursor chemicals, coordinate pickup of drugs and precursor chemicals with enrolled researchers, and conduct biennial inspections.

Select Toxin Laboratory Inspections



STANFORD UNIVERSITY

Regulatory Driver

See the Select Toxins Program section for additional details.

Background

SCA conducts periodic inspections of laboratories that possess National Select Agent Registry toxins to ensure compliance with all federal requirements for exempt quantity usage and storage.

Specialized Services Department of Chemistry

Background

In 2004, the Department of Chemistry requested that EH&S provide specific health and safety services that are normally the responsibility of the local department. This was formalized with a memorandum of understanding (MOU) for a two-year trial period starting 9/1/04. That MOU was most recently renewed in 2010 for a two-year period. EH&S provides these expanded services by assigning a SCA staff member to serve as both the Safety & Compliance Advisor and local safety contact for the Department of Chemistry.

Program Elements

Ensure all incoming laboratory personnel receive required health and safety training and that the training is documented. This involves providing safety training during the annual orientation for incoming graduate students and training provided throughout the year to new students, postdoctoral scholars, and staff. Ensure that the responsible person for each area conducts and provides documentation of self inspections. Accompany regulatory inspectors on inspections and coordinate

the response to any findings noted. Coordinate the annual chemical inventory update process. Provide guidance on the SOP development process and on how to create lab-specific training content. Advise on and respond to health and safety concerns from the departmental faculty safety committee.

Laboratory Moves

Regulatory Driver

This program element is driven by the State of California Health and Safety Code Section 25510. See the Facility Construction, Renovation, Maintenance, and Decommissioning section for additional details.

Background

Construction and renovation activities often trigger regulatory closure and notification to the County for any area containing hazardous materials. SCA assists laboratory personnel in preparing for a move and helps to minimize construction project delays due to improper closure.

Program Elements

SCA provides guidance on the safe transport of hazardous materials and laboratory equipment, proper disposal of hazardous wastes, and performs terminal radiological room and equipment decommissioning surveys. Following a move, SCA meets with new occupants to provide compliance training and assists in setting up the new research space to maximize compliance and support safety.

Special Projects

Background

SCA routinely assists EH&S technical programs, local safety coordinators, and the Utilities Water Resources and Environmental Quality manager on special projects.

Program Elements

Recent examples of the type of support provided include: Conducting a preliminary survey of shop machinery usage areas on campus following the Yale University incident to gather initial information on common machinery used, access restrictions, training, and staffing in these areas; Addressing non-compliance findings resulting from a random wastewater inspection by the City of Palo Alto Environmental Compliance Division for the Regional Water Quality Control Plant; Assisting with implementation of the University's Spill Prevention Control Plan following a generator spill reported by EH&S to the County of Santa Clara Hazardous Materials Control Division; and Safety and compliance benchmarking and program reviews in operating areas, including development of a health and safety policy for minors working in laboratories at Stanford University.

Future Needs / Challenges

Projected growth in research and laboratory facilities at the University will both increase the areas covered by the SCA Program and require additional support for laboratories moving to new and remodeled buildings. Continuation of the trend for increased scrutiny from regulatory agencies, including Cal/OSHA and the Federal Aviation Administration.

Occupational Safety

Purpose	Conduct tests and measure hazards to prevent harm to workers, property, the environment, and the general public.
Program Elements	Slip / Trip / Fall Prevention Confined Spaces Forklift Safety Ladder, Scaffolding, and Aerial Lift Safety Compressed Air and Gases Machinery and Power Tool Safety Lockout / Tagout Vehicle Safety Electrical Safety Illumination Stairs / Aisles / Walkways / Work areas / Crawl areas Fall Protection Crane Safety
Business Drivers	<ul style="list-style-type: none"> Facilities use and maintenance Construction and Remodeling projects Heavy vehicle and powered industrial truck use

Slips / Trips / Falls

Background

Incidents involving slips, trips, and falls have the potential to lead to serious

disabling injury or death. The end event (a fall) is typically caused by an unexpected change in the walking surface or a loss of



balance. Common types of issues that play a role in slip/trip/fall injuries include the following: Damaged or uneven walking surfaces (e.g. cracked or missing tiles, uprooted carpet); Slippery walking surfaces (e.g. from wet weather, dishwashing areas, kitchens, laundry rooms); Housekeeping issues (e.g. spills, debris on the floor, objects in walkways); Poorly-lit walking surfaces; Poor stairway conditions (e.g. damaged stair treads, no markings indicating the edges of first and last steps, loose/ missing stair rails); and Unguarded, elevated work surfaces (e.g. loading docks). At Stanford, slips/ trips/ falls are the second leading cause of workplace injury (#1 being musculoskeletal strains/ sprains). All campus environments are at risk of introducing these potential hazards. To ensure compliance with Cal/OSHA 8 CCR 3203, 3210, 3231, 3272 and 3273, Stanford University shall prevent slip/ trip/ fall incidents by providing awareness training, inspecting work areas, and making prompt corrections to workplace hazards.

Program Elements

Communication

Per Cal/OSHA 8 CCR 3203a(3), the OHS Program communicates information and guidance to the University Community on slip/trip/fall prevention via a *Slip / Trip / Fall Prevention Guide*, and periodic campus communications.

Slip/Trip/Fall Prevention Guide. To assist supervisors with Cal/OSHA 8 CCR 3203, 3210, 3231, 3272, and 3273 compliance, OHS developed a guidance document which provides the following information: Key safety responsibilities for supervisors, employees, and building and zone managers; A workplace inspection checklist with an inspection schedule; Control measures such as general housekeeping procedures floor treatments, shoes, floor maintenance procedures; Training requirements and schedule; Facility design guidance; and Possible product solutions.

Periodic campus communications. Prior to the rainy seasons or other conditions that may introduce increased risk for workplace slip/ trip/ fall, OHS provides reminder bulletin to building managers to inspect their facilities (per Cal/OSHA 8 CCR 3203) minimize hazard potential.

Hazard Identification, Control, and Correction

Per Cal/OSHA 8 CCR 3203, 3231, and 3273, supervisors and building managers are to inspect work areas for potential slip/ trip/ fall hazards as indicated in the Slip/ Trip/ Fall Prevention Guide. To further assist local departments with compliance, OHS provides for: Identification of specific operations or work locations having increased risk for slip/ trip/ fall via follow-up on SU-17 Incident Investigation Reports and other reports of concern; and Consultation on site-specific slip/trip/fall corrective actions.

Training

Per Cal/OSHA 8 CCR 3203(a)(7), the OHS Program provides slip/trip/fall prevention training to staff who work in areas with higher slip/trip/fall risk (e.g. dining halls, housing units). Upon request, the OHS Program provides materials to supervisors to conduct tailgate training on slip/trip/fall prevention.

Future Needs / Challenges

Since slip/trip/falls are responsible for a significant portion of Stanford's workplace injuries, OHS will continue to explore new avenues to increase awareness in preventing potentially serious injuries. Proposed interventions include:

Development of an office safety toolkit to increase slip/trip/fall awareness in administrative work areas; and

Further collaboration with University Safety Partners, building managers, department safety managers, and Building and Grounds Maintenance in enhancing workplace inspection practices.

Confined Spaces

Background

Confined spaces are enclosures that have limited means of entry and exit, and although they are large enough to get into, they are not designed for continuous employee occupancy. Examples of confined spaces include storage tanks, vaults, and manholes. Serious potential hazards often involved with confined space entry include but are not limited to asphyxiation, electric shock, heat stress or engulfment by liquids or solids. Over 300 workers are killed annually in the U.S. from confined space entry operations. Many confined space-related incidents are exacerbated by ill-fated rescue attempts made by untrained rescuers. The

Occupational Safety and Health Administration (OSHA) estimates that 85 percent of confined space-related incidents could have been prevented if proper precautions had been followed. In accordance with Cal/OSHA 8 CCR 5157 and 5158, Stanford University has developed its institutional Permit-Required Confined Space Program (link) to protect employees from confined space entry hazards. The key objectives of this program include: Proper identification of confined space and permit required confined space; Identifying hazards associated with permit-required confined space entry and rescue; Establishing permit-required confined space entry procedures/ practices, including a permit-entry system; Providing training for Stanford University employees who are assigned to enter confined spaces; and Aiding departments in their overall compliance with the Cal/OSHA regulatory requirements for confined spaces (8 CCR 5157- Permit-Required Confined Spaces 8 CCR 5158- Other Confined Spaces).

Program Elements

Written Program

As required by Cal/OSHA 8 CCR 5157(c)(4), Stanford University has developed the University's written Permit-Required Confined Space Program which describes how University departments are to comply with regulatory requirements pertaining to: Evaluation of confined spaces; Training; Standard Operating Procedures (SOP) for Permit-Required Confined Space Operations; Stanford University Confined Space Permit; Pre-approved monitoring equipment; Prevention of unauthorized entry; Responsibilities of SU employees and contractors; and Program evaluation.

Evaluation

As driven by Cal/OSHA 8 CCR 5157(c)(1) and (d)(2), the University's Permit Required Confined Space Program specifies that departments are responsible for classifying and evaluating confined spaces, and effectively identifying permit-required confined spaces via labeling and/ or inventory system. The OH&S Program offers training and technical assistance to assist departments accomplish this task. In addition, the OH&S Program has developed a confined space evaluation



STANFORD UNIVERSITY

form to assist departments with their evaluation.

Training

Cal-OSHA 8 CCR 5157(g) requires that all employees who enter permit-required confined spaces acquire the understanding, knowledge, and skills necessary for performing safe entries. At Stanford, the OHS Program makes available training resources to help departments fulfill this training need as follows:

Schedule. The OH&S Program offers a 4-hour initial confined space training class for employees who are required to be involved in confined space operations. The OH&S Program also offers a 1-hour refresher class for employees who have completed the initial training. A Confined Space Awareness class is also offered, upon request, which provides basic information to employees who are not authorized to participate in confined space operations.

The classes are offered semi-annually or more often if requested.

Training Content. The Initial Confined Space Training meets or exceeds all requirements specified by the Cal-OSHA standard. Training involves: Classroom training (overview of applicable regulations and procedures), a written exam regarding content covered during classroom training, Hands-on exercise with gas monitor equipment and permit system, and a confined space entry field exercise.

OH&S Involvement. OH&S is in charged of setting up and providing the training. Stanford Operating Procedures for Permit-Required Confined Space Operations:

As driven by Cal/OSHA 8 CCR 5157 & 5158, the OH&S Program developed written procedures to help ensure safe entries to permit-required confined spaces. Key elements covered by the standard operating procedure include: Pre-Job Planning, Pre-Entry Procedures, Atmospheric Testing, and Emergency and Rescue Procedures.

Confined Space Permit

The OH&S Program developed a confined space permit which meets all requirements of the Cal-OSHA 8 CCR 5157 (f). The OH&S Program provides training on the use of the permit during initial confined

space training and as a shop-specific training, if requested.

Pre-approved Monitoring Equipment

As driven by Cal/OSHA 8 CCR 5157 (d), the OH&S Program developed a list of pre-approved atmospheric monitoring equipment after a review. Pre-approval was based on criteria such as cost, ease of use, and current equipment being used.

Alternative Entry Procedures

As allowed by Cal/OSHA 8 CCR 5157 (c)(5), a less stringent entry procedure that do not require a permit may be used in situations where the only hazard posed in the space is an atmospheric hazard that can be controlled through continuous, forced, mechanical ventilation. The OH&S Program developed an alternative entry procedure for confined spaces which meets the requirements for alternative entry procedures.

Note: While Cal/OSHA does not require an attendant for such entry procedures, SU Permit-Required Confined Space Program requires the presence of an attendant.

Reclassification

As allowed by Cal/OSHA 8 CCR 5157 (c)(7), the OH&S Program developed a process to allow reclassifying a permit-required space into a non-permit required confined space. Reclassification is allowed when a permit space: Poses no actual or potential atmospheric hazards, and all the other hazards within the space are eliminated without entry into the space. The permit space may be reclassified as a non-permit confined space for as long as the non-atmospheric hazards remain eliminated. Note: Reclassification of confined spaces is a process that involves both OH&S and all affected department(s) whose employees or contractors will enter such spaces.

Contractors

As driven by Cal/OSHA 8 CCR 5157 (c)(8)(A), contractors who enter permit-required confined spaces are to be informed of any known potential hazards associated with the space. Whenever contractors conduct an entry to a permit-required confined space, the job shall be coordinated so that neither the contractor nor the University's employees jeopardize each other's safety. The University's written program describes the process for

managing work contractors perform in the installation's confined spaces.

Program Evaluation

As required by Cal-OSHA 8 CCR 5157 (d)(14), the OH&S Program conducts an annual review of the confined space program. The annual review includes: A paper review of cancelled permits for thoroughness and accuracy, and a field audit to evaluate how hazards area assessed, how the space is prepared for entry, the appropriate use of special equipment and PPE, and how air monitoring is performed. The OH&S Program must also review the program if the shop supervisor or EH&S believes that entry procedures are not adequate to protect employees.

Future Needs / Challenges

The OH&S Program was recently informed of future plans involving the conversion of current steam vaults. Such conversation may impact future confined space entries as these new vaults may be entered via an "alternative method". The decision to conduct entries under such new methods will require the review of several years of cancelled permits and will be an on-going project. The OH&S staff will continue to maintain the Confined Space Program to ensure its compliance with Cal-OSHA 8 CCR 5157- Permit-Required Confined Spaces, and 8 CCR 5158- Other Confined Spaces.

Forklifts

Background

Powered industrial trucks, commonly called forklifts or lift trucks, are used to move large and heavy materials. The use of forklifts instead of carrying materials by hand reduce the risk for back injury, however, there is a risk of injury or death when forklift operators are not adequately trained. Annually, over 100 workers are killed and 20,000 are seriously injured in forklift mishaps. Compared to the general hazards associated with operating a conventional automobile (e.g. speed, pedestrians), powered industrial trucks have unique hazards due to the design and operational differences: Higher center of gravity (higher risk for truck over-turning), Rear-wheel steering (requires different maneuver techniques), Much heavier and poorer suspension, and Risk for operator's body and parts caught in forklift. In accordance with Cal/OSHA 8 CCR 3649-



3665, Stanford University has developed its institutional Forklift Safety Program (link) to minimize hazards to operators and co-workers associated with the use of forklifts and/or other powered or non-powered industrial trucks or lifts. Methods to protect personnel include: Use of safe operating procedures, Pre-shift inspections, and Provision of employee training/certification. The Forklift Safety Program applies to Stanford University employees who work with forklifts and/or other powered or non-powered industrial trucks or lifts or are responsible for their operations (8 CCR 3649-3665). There are currently approximately 100 Stanford University employees trained to operate forklifts.

Program Elements

Training

Cal-OSHA 8 CCR 3668 requires the employer to ensure each powered industrial truck operator is competent to safely operate the vehicle. Training is required prior to the employee's initial operation. Training is the main element required by Cal-OSHA in regards to forklift safety. The OHS Program offers Forklift training on an as-needed basis. Shops or departments may specifically request for a staff training session.

Forklift safety training is provided to all employees who operate forklifts. Training provided by OHS involves class training and a hands-on session where operators are trained and observed operating a forklift. The training lasts for 2 hours and employees are trained and informed of the following: Pre-shift forklift inspection; Truck-related topics (e.g., Operating instructions, warnings, and precautions for the types of truck the operator will be authorized to operate; Differences between truck and a conventional automobile; Truck controls and instrumentation: where they are located, what they do, and how they work; Steering and maneuvering; Visibility (including restrictions due to loading); Fork and attachment adaptation, operation, and use limitations; Operating limitations: vehicle capacity and stability; and Safe refueling procedures); and Workplace-related topics (e.g., Closed environments and other areas where insufficient ventilation or poor vehicle maintenance could cause a build-up of carbon monoxide or diesel exhaust; Surface conditions where the vehicle will be operated and where stability could be affected; Load

manipulation, stacking, and unstacking; and Pedestrian traffic, narrow aisles and other restricted areas where the vehicle will be operated). Employees are trained prior to initial operation of any forklift. Refreshers are provided for forklift operators, depending on length of current certification (annual or biennial). Training records are maintained by the Supervisor for a minimum of one year. For each training, OHS is involved in: Coordinating with supervisor to ensure forklift is available and inspected prior to the training session; Organizing and providing the training; and Issuing certification cards at completion of training. In addition, Cal-OSHA 8 CCR 3650 (t)(7) requires the forklift to be inspected at the beginning of each shift when it is operated. The OHS Program has developed a pre-shift inspection form to assist operators for such inspection.

Future Needs / Challenges

The Forklift Safety Program will be continually maintained according to Cal-OSHA 8 CCR 3649-3665.

Ladder, Scaffolding, and Aerial Lifts

Regulatory Drivers

EH&S provides consultation to supervisors and employees to ensure compliance with the following Cal/OSHA regulations: Ladders (8 CCR 3276-3278), Mobile ladder stands (8 CCR 3627), Scaffolding (8 CCR 1503, 1635-1667, 3275, and 3620-3626), and Elevated work platforms and aerial devices (8 CCR 3636-3648).

Background

Ladders, scaffolding, aerial lifts, and other elevated platforms allow work to be performed at elevated work locations. However, substantial fall risks and serious consequences are associated with each type of equipment. *Portable ladders* (e.g. extension and step ladders) are one of the most commonly used pieces of equipment in industry. They are easy to carry, versatile and used in a variety of jobs. However, improper use of ladders can lead to a fall, potentially resulting in serious injury or death. *Scaffolding* is used intermittently on campus for small-scale maintenance or research projects. Although the scaffolds are not regularly used, they are similar to ladders in that the

potential injury severity of unsafe practices is very high. *Aerial lifts* provide convenient access to elevated locations. Similar to scaffold use, they are not frequently used on campus, however, the potential for severe injury/fatality with these types of safety failures is high. Consultation services include: Assisting supervisors in analyzing work activities for potential hazards and controlling such hazards; Promulgating general guidance information to ensure staff follow proper work practices and use appropriate safety devices to prevent fall injuries and fatalities; and Providing proper training for work on ladders, scaffolding, and other elevated locations.

Program Elements

Job Hazard Analysis and Control

Hazard Assessment: Per the Cal/OHSA IIPP Standard 8 CCR 3203, supervisors are responsible for assessing potential job hazards on a periodic basis and whenever new hazards are introduced into the workplace. The OHS Program assists supervisors in determining hazards involving ladders, scaffolding, and aerial lifts by providing a general job safety analysis tool and by conducting surveys of department work operations.

Hazard Control: Based on the results of job hazard analysis/survey, the OHS Program provides on-going consultation and support to the supervisor in addressing any deficiencies. The major methods of protecting workers from falls include: Eliminating the fall hazard by performing work on ground, etc.; Preventing employee exposure to falls such as guardrail systems and fall protection (described in the Fall Protection section); and Controlling the fall hazards by ensuring proper training and work practices.

Communication

Per Cal/OSHA 8 CCR 3203(a)(3), the OHS Program communicates information and guidance to University groups that use ladders, scaffolding, elevated platforms, and aerial lifts. The *Guidelines for Ladder Safety* assists supervisors with Cal/OSHA 8 CCR 3276 compliance, OHS developed a guidance document which provides the following information: Ladder selection, inspection, and maintenance practices; and Safe ladder practices. The



Code of Safe Practices are procedural documents designed to be included in an at-risk department's manual of safe operating procedures required for: Ladders (8 CCR 3276-3278), Scaffolding erection (8 CCR 1635-1667), Scaffolding use (8 CCR 1635-1667), and Elevated platforms and aerial lifts (8 CCR 3646 and 4648).

Training

Where needed, the OHS Program provides additional general training on ladder safety. For equipment-specific training on scaffolding, aerial lifts, and elevated work platforms, department supervisors are advised to work with the particular equipment's manufacturer or qualified person. For any other specialized training, the OHS Program works with department supervisors to identify training needs and help selected contracted training providers.

Future Needs

Communication Efforts. The OHS Program continues to explore strategies to promoting ladder, scaffolding, and aerial lift safety with maintenance, research, and other at-risk University groups. Projected efforts include: Enhanced supervisor tools to assess job hazards; Enhanced guidance/training materials; and Increased outreach efforts, particularly in non-maintenance units, for ladder, scaffolding, and aerial lift safety awareness.

Compressed Air and Gases

Regulatory Drivers

Pertinent state and federal regulations include: Use of Compressed Air and Gases (8 CCR 3301), Air Tanks (8 CCR 461), Oxygen, Acetylene, and Fuel Gas (8 CCR 1740), and Storage, Handling and Use of Cylinders (8 CCR 4650).

Background

Compressed air and gases are used in hundreds of locations on campus including laboratory buildings for research purposes and shop facilities. Compressed gases can pose chemical and physical hazards. Hazards are created by the toxicity of the gas, the flammability, reactivity, possibility of asphyxiation, and from pressure. Proper maintenance, monitoring for leaks, proper labeling, storage, handling, and transportation of compressed gases is critical.

Program Elements

Location

According to Cal/OSHA 8 CCR 4650 (b), compressed air and gas cylinders are required to be stored in well-protected, well-ventilated areas. Whenever new storage areas are built, the OH&S program review construction drawings to verify cylinder storage areas are appropriate and meet Cal/OSHA requirements.

Surveys

During baseline and follow-up Industrial Hygiene and Safety surveys, use of compressed air is evaluated to ensure Cal/OSHA compliance. The following is involved: Evaluation of the use of compressed air; Review written documentation (i.e., employee training records); Storage, including sign posting; Handling, including proper lifting; and Transportation. If any deficiencies are identified, the supervisor is informed by the OH&S Program of any necessary corrective action. When necessary, the OH&S Program provides on-going consultation and support to the supervisor in addressing the deficiencies.

Training

The OH&S program has developed two training formats for compressed air and gases: Online training (available through <http://axess.stanford.edu>) and Classroom training (30-minute training offered annually or more often if requested). Annually, approximately 1500 University personnel/ students take the compressed air and gas safety training. The content of the training is based on guidance provided by Cal/OSHA 7 CCR Section 3301 & 4650, which covers the following topics: Use of compressed air and gases, Storage and handling of cylinders, Inspection, and Safety devices. Note: The OH&S Program has recently revised both online and classroom trainings.

Machinery and Power Tools

Regulatory Drivers

In accordance with specific the following Cal/OSHA regulatory standards, shop machinery/ tools use and maintenance shall be performed in a safe manner: Machine Guarding (8 CCR 3940 – 4647), Hand and Power Tools/Equipment (8 CCR 3444-3464, 3940-4647), Cleaning, Repairing,

Servicing and Adjusting Prime Movers, Machinery and Equipment (8 CCR 3314), and Injury and Illness Prevention Program (8 CCR 3203).

Background

Moving machine parts have the potential to cause severe workplace injuries, such as crushed fingers or hands, amputations, burns, or blindness. Safeguards are essential for protecting workers from these preventable injuries. Purposes, including but not limited to, research experiments/projects and facilities maintenance needs. Due to the wide diversity of user groups on campus, it is essential that the University establish clear guidance on how departments are to properly manage safe usage of machinery and power tools.

Program Elements

Location

Carpentry and metal working machines are found in several shops at Building/ Grounds Maintenance, Student Housing, and in numerous academic/ research shops on campus (e.g., Varian machine shop, Mechanical Engineering Shop, etc.). Power tools are relatively ubiquitous on campus, but are used primarily by trade shops listed above.

Surveys / Inspections

Per the University's Injury/ Illness Prevention Program (Cal/OSHA 8 CCR 3203), departmental managers/ supervisors are required to locally conduct scheduled periodic inspections to identify, evaluate, and address unsafe conditions and work practices. The OHS Program assists departments by conducting baseline and follow-up safety assessments as needed. Machinery and power tool operations are assessed during these surveys, when these tools are present in the work area. The survey process involves: Identifying all of the machinery and types of hand and power tools in the shop; Inspecting machinery to ensure it has appropriate guarding in place; and Review written documentation (i.e., SOPs for operation of the machinery and tools, lockout/tagout procedures, and employee training records). If deficiencies are identified, the supervisor is informed by the OHS Program of any necessary corrective action. As appropriate, the OHS Program provides on-going consultation and support



to the supervisor in addressing the deficiencies.

Training / Communication

In compliance with Cal/OSHA 8 CCR 3203(a)(7), employees assigned to use machinery and power tools must be trained on safe operating practices/ procedures. Basic safety training on machinery and power tool use is available from the OHS Program. Equipment-specific training on safe operation of machinery and power tools is provided by local shop management.

The OHS Program provides guidance to PIs and supervisors on assuring safe use of machinery and power tools. PIs and supervisors are expected to assure the safety of their personnel via the following measures: Establishing local rules to ensure effective access control to only authorized users competent in safe equipment/ tool operation; Establishing local Standard Operating Procedures (SOPs); Utilizing guards or safeguards per the machine manufacturer; and Performing electrical lock-out prior to non-routine adjustments.

Future Needs / Challenges

Although regulations do not require a written program for this topic, OHS Program jointly with Laboratory Safety has developed guidance materials to help campus shops safely manage machinery work within their facilities. EH&S will continue to evaluate potential areas for further enhancement as needed.

Lockout / Tagout

Background

Lockout/ tag safety is an essential element in preventing accidents that may result in serious injury or death. Shop maintenance personnel who are required to maintain/ repair machinery should be fully aware of proper lockout/tag procedures & precautions. Cal-OSHA 8 CCR 3314 requires that service or maintenance performed on machines or equipment must be done with the machine stopped, all sources of energy disconnected, and energy devices locked out or tagged out under a documented procedure. Machines or equipment that have lockable controls must be locked-out in the “off” position during repair or service work. Machines or equipment do not have lockable controls must be de-energized, disconnected from

the source of power, or otherwise prevented from moving.

Program Elements

Training

The Standard requires that employees involved in lockout/tagout programs be trained. The OHS Program has recently developed a training program for lockout/tag operations.

Written Procedure

A written energy control procedure must be developed and utilized when employees clean, repair service or adjust machines or equipment. The procedure must outline the scope, purpose, authorization, rules and techniques to control hazardous energy, and the means to enforce compliance.

Inspections

An inspection must be conducted at least annually to ensure continued effectiveness of the program. The inspection must include a review of the procedures with all affected employees.

Contractors

Outside contractors are required to follow Stanford University’s lockout/tagout procedures.

Responsibility

At present, it is the responsibility of the supervisor or the shop, lab or other area where lockout/tagout procedures are used to develop written procedures and conduct necessary training and inspections. The OHS Program provides technical assistance to supervisors.

Future Needs / Challenges

The Lockout Tagout Program will be continually maintained to ensure compliance with Cal-OSHA 8 CCR 3314.

Vehicle safety

Background

Vehicular traffic accidents can cause injury to Stanford University employees and third parties, and cause property damage. Applicable regulations include the California Vehicle Code and Cal/OSHA 8 CCR 3203.

Program Elements

Departments Responsible

Currently, Public Safety enforces vehicle safety on campus (e.g., speed limits, parking, follow-up to accidents, moving violations). Work-related driving accidents involving employees are reported to Risk Management. The OHS Program has become involved in following up, in particular, to accidents involving golf carts.

Location of Vehicle

Various University departments own vehicles - ranging from just a few, to an entire fleet. Type of vehicles include: passenger cars, trucks, specialized equipment (e.g., tractors, tree booms, etc.), golf carts, etc.

Training

On an annual basis, larger departments (e.g., Facilities Operations and Residential and Dining Enterprises) generally bring in speakers to train their employees on defensive driving techniques.

Golf Cart Use

OHS Program has developed a policy on safe operation, procurement, and registration of golf carts on campus and is involved coordinating related policies with affected parties.

Future Needs / Challenges

Depending on discussions with Public Safety, Risk Management, and the OHS Program, the responsible party for the development of a written program overseeing vehicle safety and associated training will be determined.

Electrical Safety

Background

Electricity has long been recognized as a serious workplace hazard, with the potential to cause severe injury or death from electric shock, electrocution, fire, or explosions. At Stanford, electricians, researchers, and other professionals work with electricity directly, including work on facility systems, electrical equipment, and research apparatus. Others, such as office workers, work with electricity indirectly but may also be exposed to electrical hazards (e.g. power strips and extension cords). Typical work activities that have a higher degree of electricity-related risk include the following: Operating, installing, testing, maintaining, repairing,



STANFORD UNIVERSITY

or removing electrical equipment or systems; Designing, fabricating, or modifying electrical equipment or systems; and Other tasks which may require working near exposed energized conductors/ equipment (e.g., tree trimming near power lines). To protect Stanford employees, affiliates, and students from electricity-related hazards and to ensure compliance with Cal/OSHA Low Voltage Electrical Safety (8 CCR 2299-2599) and High Voltage Electrical Safety (8 CCR 2700-2974) as well as the National Fire Protection Agency (NFPA 70e), the OHS Program provides workplace hazard communications and general electrical safety training.

Program Elements

Communications

Per Cal/OSHA 8 CCR 3203 a(3), the OHS Program communicates electrical safety guidance to the University community, with special attention to Building and Grounds Maintenance staff, facility management, researchers, and any other target group with potential direct exposure to electricity during work operations. The *Electrical Safety Guidelines* assists supervisors and employees with Cal/OSHA 8 CCR 2299-2599 and NFPA 70E compliance, OHS developed a guidance document which provides general electrical safety guidance and safe practices for low/moderate risk work activities (office work, general research operations).

Training

Cal/OSHA 8 CCR 3203 requires employees to make employees aware of the potential hazards to which they are exposed, including training employees in safe work practices and any other procedures necessary for protection from electrical hazards.

For all University personnel, the OHS-produced IIPP/General Safety training provided basic electrical safety information. For lab and shop personnel, the OHS Program developed general electrical safety training. Operation-specific training is provided by the department supervisor.

Consultation

Where needed, the OHS Program investigates electrical safety concerns; such investigations may involve

collaboration with the SU Fire Marshal's Office and the SU Electric Shop.

Future Needs / Challenges

To further assist Stanford supervisors/PIs, the OHS Program will refine general electrical safety guidance and training programs, while assessing the need for a formal written program.

Illumination

Background

Illumination is a measure of the amount of light falling on a work surface or task. Illumination is a safety, as well as an ergonomic concern.

Cal-OSHA requires that working areas, stairways, aisles, passageways, work benches and machines have enough natural or artificial illumination to be reasonably safe. Cal-OSHA lists minimum illumination levels (8 CCR 3317) for various areas. In addition, the amount and quality of light in the workplace can affect job performance and comfort. Without adequate lighting, important task elements may be incorrectly seen or not be seen at all. Good lighting must meet the following requirements: Good illumination, Uniform lighting, Avoidance of glare, Appropriate contrast, Correct color, and Avoidance of flicker.

Program Elements

Surveys

The OHS Program conducts lighting surveys in response to complaints, including inadequate lighting and glare. Results are compared with the Cal-OSHA standard and Stanford Facility Design Guide, as appropriate.

Future Needs / Challenges

A written program for this particular safety topic is not needed. The OHS Program will integrate this topic into a general health and safety written program. Given other programmatic priorities, it is anticipated that the written program will be completed approximately between the years 2004-2006.

Stairs / Aisles / Walkways / Work areas / Crawl areas

Regulatory Drivers

Relevant Cal/OSHA regulations include: Aisles, Walkways, and Crawlways (8 CCR 3272), and Working Area (8 CCR 3273).

Background

Machinery, equipment, parts and stock that encroach on aisles, walkways, crawlways and work areas can pose a hazard in terms of hindering the ability of employees to safely exit a space under routine or emergency conditions. Also, if not kept clean and dry, these paths can pose a slip or trip hazard to employees.

Program Elements

Location

Stairs and aisles, walkways, and crawlways are found throughout campus.

Surveys

Per 8 CCR 3203, employers are required to conduct scheduled periodic inspections to identify and evaluate unsafe conditions and work practices. The OHS Program assists departments by conducting baseline and follow-up industrial hygiene/safety surveys. During these surveys, work areas are inspected to ensure they are clear and maintained free of slip and trip hazards. If any deficiencies are identified, the supervisor is informed by the OHS Program of any necessary corrective action. As appropriate, the OHS Program provides on-going consultation and support to the supervisor in addressing the deficiencies.

Training

Currently, training regarding stairs, aisles, walkways, crawlways, and work areas is generally conducted as Tier 3 level training, provided as a tailgate training by the supervisor.

Future Needs / Challenges

Written Program: A written program for this particular safety topic is not needed. The OHS Program will integrate this topic into a general health and safety written program. Given other programmatic priorities, it is anticipated that the written program will be completed approximately between the years 2004-2006. **Training:** This topic is suited best as a tailgate training, rather than a single dedicated training session offered by EH&S. Therefore, the OHS Program will develop training handouts to assist supervisors.



Fall Protection

Background

Falls from heights are a leading cause of work-related serious injuries and fatalities. Incidents involving falls are generally complex events frequently involving a variety of factors, including: Poorly designed elevated work areas (e.g. insufficient guardrails); Working on roofs; Improper use of equipment; and Inadequate or poorly designed fall protection. Consequently, the Cal/OSHA 8 CCR 1669-1671 and 3209-3213 requirements for fall protection involve both work procedures and equipment-related issues in order to protect workers from recognized fall hazards. Per 8 CCR 3203, supervisors have a duty to anticipate the need to work at heights and to plan work activities accordingly, meaning effective incident prevention must be incorporated into the job planning process. To ensure compliance with Cal/OSHA 8 CCR 1669-1671 and 3209-3213, the OHS Program provides fall protection consultation to University departments that perform construction, maintenance, or research activities at elevated work locations including, but not limited to, rooftops and aerial lifts. Such consultation services include: Job hazard analysis and control support for department supervisors; Guidance documentation for elevated work locations; and General fall prevention/protection training.

Program Elements

Job Hazard Analysis and Control

Hazard Assessment: Per Cal/OHSA 8 CCR 3203, supervisors are required to assess potential hazards for work operations. The OHS Program assists supervisors in identifying potential workplace fall hazards from elevated work locations. The assessment typically involves: Evaluation of the planned work activity and equipment; As needed, an on-site visit to the work area; and Review of applicable regulatory requirements, established standards, and industry best practices. **Hazard Control:** Based on the results of job hazard assessment, the OHS Program debriefs the supervisor on any

required actions as well as safe work practices. Fall protection typically involves the following controls, in order of preference: Eliminating the fall hazard by performing work on ground, etc.; Passive fall protection (e.g. guardrails); Fall restraint systems (e.g. lanyards); Fall arrest systems (e.g. energy-absorbing lanyards); and Administrative controls such as proper training and work practices (e.g. controlling access to areas with fall hazards).

Communication

Per Cal/OSHA 8 CCR 3203 a(3), the OHS Program communicates select fall prevention information and guidance to University groups. The *Guidelines for Safe Roof Access* assists supervisors with Cal/OSHA 8 CCR 1670 and 3209-3212 compliance, OHS developed a guidance document provide information on fall prevention requirements and safe work practices for rooftop work operations. The *Code of Safe Practices* are procedural documents designed to be included in an at-risk department's manual of safe operating procedures. The following documents describe key fall protection elements: Scaffolding erection (8 CCR 1635-1667), and Elevated platforms and aerial lifts (8 CCR 3646 and 4648).

Training

If a fall protection need is established, the OHS Program works with department supervisors to identify training needs and help select contracted training providers.

Future Needs / Challenges

Communication Efforts: The OHS Program will explore strategies to assist maintenance, research, and other at-risk University groups in fall protection awareness and potential strategies. Focused efforts are to include: Supervisor/PI fall hazard assessment tools; Guidance addressing strategies for eliminating potential fall hazards (e.g. doing work from the ground, installing guardrails); and Outreach to building / zone management to ensure access to roof surfaces and other elevated locations are restricted to authorized personnel (e.g. ensuring doors to rooftops are locked). **Training:** Where

needed, the OHS Program will develop generalized fall prevention training materials for at-risk departments.

Crane Safety

Background

Overhead lifting devices including cranes, gantries, jibs and hoists are found in throughout campus. Aerial lift trucks are used by Facilities Operations for high-voltage and tree maintenance work. Indoor cranes used for hoisting equipment into mechanical rooms, etc. and are used by facilities personnel. Indoor cranes are also found in laboratories and are associated with research operations. During the summer of 2002, a survey was distributed to University Safety Partners and Zone Managers to identify the different types/locations of cranes and to ascertain the level of crane maintenance and operator training. A site inspection was conducted in follow-up to the survey, utilizing the expertise of Zurich – the University's Insurance Carrier. The outcome of this effort was to develop a Tier II training on cranes, for facilities personnel and laboratory operators to review and clarify Cal/OSHA's inspectional, training and crane maintenance requirements. The training is to be delivered in January 2003.

Future Needs / Challenges

As this is an emerging program, additional written guidance materials will be developed on an as-needed basis.



Purpose	Protect and promote employee health and maintain readiness for work; Offer easy medical access, prompt evaluation, and follow-up care; Implement standardized care models; Develop close working relationships with internal and external stakeholders.
Program Elements	Industrial Injury / Illness Care – Workers’ Compensation Medical Surveillance Medical Records Management Medical Case Management and Return-to-Work Program Support Wellness / Prevention Services Automatic External Defibrillator (AED) Program (Medical Oversight) Education / Teaching Activity SLAC Site Operations
Business Drivers	<ul style="list-style-type: none"> • Workers’ Compensation cases • Workplace hazard exposures • Employee absenteeism rates

Purpose and Scope

The overall health of employees is an important factor in their ability to work effectively and safely. The occupational medicine program at Stanford University consists of services that assist in worker protection from occupational hazards. It also serves in the promotion of good health amongst employees. The program focuses on the prevention of occupational injuries and illnesses or in the detection of them at an early stage. When industrial injuries and illnesses do occur, the occupational medical program provides treatment and medical management of such conditions. The occupational medicine program strives to improve the overall quality and effectiveness of its services by providing an onsite center that offers easy access for university personnel as well as prompt evaluation and follow-up care; through implementation of standardized care models that are evidence-based and meet “best-practice” guidelines; and through development of close working relationships with internal and external stakeholders. By protecting and promoting the health of university employees and maintaining their readiness for work, the occupational medicine program aims to reduce unnecessary health-related costs and loss of productivity due to elevated employee absenteeism and presenteeism rates. The program complies with Cal-OSHA regulations, Workers’ Compensation laws, and other statutory requirements.

Access to Occupational Medical Services

Stanford University Occupational Health Center provides comprehensive occupational medical services to all university faculty and staff, and to university students, postdoctoral scholars, visiting researchers, and volunteers who are subject to required medical surveillance or who sustain an industrial injury/illness during work activities at Stanford University.

Program Elements

The core functions of the occupational medicine program include: 1) Management of Industrial Injury/Illness Care – Workers’ Compensation, 2) Medical Surveillance, 3) Medical Records Management, 4) Medical Case Management and Return-to-Work Program support, 5) Wellness/Prevention Services, 6) Automatic External Defibrillator Program (medical oversight), and 7) Medical Education/Teaching Functions.

Workers Compensation

The Occupational Health Center at Stanford University is the designated provider for all university personnel who sustain a workplace injury or illness, except for those employees who have pre-designated an outside clinician to be their primary treating provider for Workers’ Compensation claims. During the first 30 days following injury, university personnel are required to have all medical evaluation and treatment (or coordination of care if specialist treatment is indicated) provided by the clinical team at Stanford University Occupational Health Center (SUOHC). After thirty days, university personnel may choose to transfer care to any provider who accepts Workers’ Compensation insurance.

SUOHC Approach & Goals

The SUOHC clinical team provides medical evaluation and treatment of workers who have experienced an occupational injury or illness and monitors their health status so as to facilitate their rehabilitation and safe return to work. Clinical staff at SUOHC provide accurate and timely diagnosis followed by implementation of an effective and efficient individualized treatment plan. SUOHC is committed to quality patient care, timely communication with all parties, and prompt return to work.

Referral Diagnostic Services

When indicated, the following diagnostic and referral services are provided by SUOHC clinicians: 1) Diagnostic testing, including x-ray, ultrasound, and CT/MRI imaging studies; laboratory testing; and EMG/NCS neurodiagnostic testing; 2) Referral to rehabilitation programs including physical therapy, acupuncture/acupressure, chiropractic care, and work conditioning; and 3)

Referral to a specialist when indicated. SUOHC uses a carefully selected network of specialists in Hand Surgery, Orthopedics, Spine Surgery/Neurosurgery, Physiatry, Podiatry, ENT, Ophthalmology, Allergy & Pulmonology, and Dermatology. These include specialists within Stanford School of Medicine as well as external private practitioners. SUOHC clinicians also provide recommendations for employee self-referral to Stanford University HelpCenter when indicated.

Workers’ Compensation Authorization for Diagnostic Testing and Referrals

In order to provide timely and efficient medical care, SUOHC has negotiated prior authorization from Zurich NA for a number of commonly utilized interventions and treatments. SUOHC clinicians are pre-authorized to provide patient referral for physical therapy (up to #12 visits per claim), acupuncture (#12 visits per claim), and chiropractic care (#12 visits per claim). SUOHC clinicians also have prior authorization for ordering diagnostic studies (including MRI and EMG/NCS) as well as for referrals for specialist consultation. This helps facilitates rapid treatment of our patients and prevents delays in care due to Workers’ Compensation authorization issues utilizing the standard Utilization Review process.

Communication



SUOHC clinicians provide electronic communication of an employee's initial work-related injury or illness as well as the employee's "Work Status" report on a timely basis to his or her supervisor and Human Resource manager, to the OSHA 300 Log Records Manager, and others with a need to know in accordance with state and federal laws and with Stanford University policy. Electronic communication does not include confidential medical information (such as diagnosis or treatment plan). SUOHC clinicians communicate directly with EH&S health and safety specialists, relaying injury/illness causation information in order to facilitate accident investigation and the mitigation of workplace hazards. Additionally, OHC clinicians work with Risk Management personnel and Human Resource managers to facilitate return-to-work of the injured worker when temporary accommodations for workplace restrictions are indicated.

Trends in Workforce

The Occupational Health & Safety staff collects and maintains relevant medical and workplace information pertaining to injuries and illnesses at Stanford University. An annual RECAT (Risk Engineering Claims Analysis template) Report is also obtained from Zurich NA. Analysis and interpretation of this data helps identify loss trends and leading and lagging indicators, thereby allowing for more targeted intervention strategies by Risk Management, Occupational Health & Safety officials, and other university stakeholders in order to mitigate future risk of occupational injuries/illnesses amongst faculty and staff. Data tracked includes 1) Clinic utilization rates, 2) Injury/Illness case complexity/severity, 3) First Aid vs. DART claim rates, 4) Laboratory animal related injuries/illnesses, 5) Accommodation of restricted work by department, 6) Claim costs, and 7) Comorbidities and age of employees who sustain industrial injuries/illnesses, and effect of these on claim severity, cost, and time to resolution.

Future Needs / Challenges

The following are projected future needs for the Injury/Illness Care component of the Occupational Medicine Program at Stanford University. **Workers' Compensation Injury / Illness Care.** Since assuming responsibility for all Stanford University Workers' Compensation

injury/illness claims in January 2009, SUOHC has realized a moderate annual growth in WC injury/illness care utilization. We believe that this is now reaching a plateau at approximately 50 initial evaluations for new industrial injuries/illnesses per month, and 250 follow-up visits per month for ongoing injury/illness care. It appears that the current clinician staffing model is approaching an optimum level to meet this demand. We currently utilize 2.8 FTE clinician time (2.0 mid-level providers and 0.8 FTE MD providers, with 90% of that time devoted to WC Injury/Illness care) to meet WC visit demand. However, currently >95% of all Permanent & Stationary Evaluations and Permanent Impairment Ratings are referred to an outside physician for completion (at considerable expense). In order for SUOHC to assume this function, an additional 0.18 – 0.23 FTE physician time would be required. **Cost reduction.** The current model of care at SUOHC has consistently resulted in lowered overall WC medical and indemnity costs over the last three calendar years. It is unlikely that further cost reductions will be achieved through further medical care efficiency. Future cost savings are likely to be realized only through improvement of the "return-to-work" program, and through increased departmental accommodation of workers who have temporary work restrictions. **Return-to-Work.** There remains poor acceptance of "restricted work" for WC claims in several critical university departments, leading to excessive "Lost Workdays" on the OSHA 300 Log, excessive indemnity costs, and poorer patient outcomes. In order to have a greater impact on controlling Workers' Compensation costs and improving health outcomes, SUOHC staff will need to work more closely with university and department leadership, Risk Management, and EH&S officials to increase both awareness of the importance of early return-to-work for injured employees and accommodation of those workers with temporary restrictions. **Severity and Complexity of cases.** SUOHC has observed a significant increase in the severity and complexity of industrial injuries and illnesses presenting to our clinic in the last 12 months. This has resulted in increasing numbers of lost or restricted workday claims as well as an overall increase in net costs of both "medical only" and DART claims. There

has been a significant increase in need for specialist consultation, specialty diagnostic testing such as MRI or neurodiagnostic testing, and interventional management. SUOHC staff will need to partner with EH&S and other key stakeholders in order to promote an increasing awareness/culture of safety campus-wide and within targeted departments with high injury/illness case rates. **Space.** The current space allocation is inadequate for WC injury/illness care provision. Though WC injury/illness clinic utilization rates are stabilizing, we anticipate a significant increase in clinic utilization for medical surveillance in the next year. Further space allocation will be necessary in the next 12 months; in the absence of this, significant delays in care can be expected in both injury/illness care and medical surveillance care.

Medical Surveillance

Medical surveillance serves as a primary and secondary prevention tool: its purpose is to protect the health of university personnel through the periodic monitoring of workers with similar exposures and through feedback of findings to the worker and the workplace. Medical surveillance provides the opportunity for clinical staff to educate personnel about potential health consequences related to workplace exposures specific to their job. It provides an opportunity to review best work practices, acute management of any exposure incidents, and reporting procedures for any health concerns. Medical monitoring, when indicated, allows for the early identification of medical conditions that could potentially lead to adverse impacts on the worker's health. It also provides the opportunity for targeted intervention to mitigate workplace exposures through improved engineering, administrative, or personal protective equipment controls. Based on assessment of workplace hazards by industrial hygiene, biosafety, and health physics professionals, the Medical Director of SUOHC makes determinations of the need for medical surveillance depending on the nature of workplace health exposures identified for specific university personnel. Established medical surveillance programs at SUOHC also assure compliance with federal and state regulations that trigger medical monitoring when employees use certain materials or have various workplace exposures at or above action levels. In California, Cal/OSHA (Title 8,



STANFORD UNIVERSITY

CA Code of Regulations) establishes medical surveillance requirements for workplace exposure to specific chemicals, physical, and biological agents. Cal/OSHA requires that employers offer such a program at no cost to the employees. Because laws governing medical surveillance require only that medical surveillance evaluations be made available to workers, it is a worker's option to decline such evaluation. However, mandatory biological monitoring requirements may apply in some cases, such as annual tuberculosis screening for healthcare providers.

Future Needs / Challenges

Job Demands Worksheet. A "Job Demands Worksheet" is not currently utilized by hiring supervisors or HR Managers to assess needs for employee medical surveillance based on physical demands and specific environment conditions and potential risks of a given job. This needs to be implemented for easy assignment of employees to required medical surveillance by hiring manager or supervisor.

Centralized software. Currently, a central university-wide software platform is not utilized for assignment of employees by their supervisor/HR for specific medical surveillance based on their job category. As a result: 1) There is no accurate way for SUOHC to know which employees require medical surveillance, and 2) There is no central method for verification of whether a particular employee has been removed from surveillance program or remains assigned. This requires multiple phone calls to employee and/or supervisor to confirm need for ongoing surveillance. The lack of a central assigning & tracking software database allows for many potential gaps in regulated surveillance, thereby reducing the opportunity for primary and secondary prevention of injuries/illnesses amongst employees who are a risk of various workplace exposures. For example, SUOHC does not currently receive notification of employees who work with human blood/OPIM. As a result, we are unable to offer HBV vaccination, verify immunity, or obtain

signed declination for affected employees as required by Cal-OSHA BBP Standard. SUOHC and EH&S personnel are currently investigating various options to implement a platform as described above at Stanford University.

Medical Questionnaire. At the present time, completion of the LAOHP Medical Questionnaire for medical evaluation (and subsequent surveillance as indicated) is voluntary for all researchers (students, postdocs, employees) who are rodent handlers/users. Furthermore, there is no periodic medical surveillance offered for researchers who work with rodents. Due to a significant observed incidence of laboratory animal allergy development in rodent users (diagnosed in graduate students, postdocs, and researchers), SUOHC plans on implementing mandatory baseline and annual medical surveillance for all personnel who work with lab animals.

Offsite vendor use. A number of departments continue to utilize offsite vendors for required medical surveillance. Audits have not been performed to determine adequacy of services provided by these external vendors, or whether appropriate reporting procedures and interventions are being undertaken for early positive findings during medical screening (such as with a finding of a STS on annual audiogram). Medical documentation for these services is also currently being maintained by the department HR manager. SUOHC will need to audit these programs in the next 1-2 years to verify adequacy of care and documentation compliance. Ideally, SUOHC will gradually assume control of these programs and eventually provide all mandated surveillance at Stanford University.

Pre-travel assessments. SUOHC currently performs a limited number of pre-travel medical assessments for work-related international travel. CDC travel guidelines are followed, and necessary vaccinations and malaria prophylaxis are provided as needed. It is likely that SUOHC will need to play an increasing role in provision of travel clinics in the next 2-3 years.

Medical Surveillance. There is an ongoing need to evaluate for other potential surveillance requirements on campus, such as for confined space users, forklift/powerd industrial vehicle operators, crane operators, diving certification (Hopkins Marine), among others. Given the realized and projected increase in medical surveillance at SUOHC, additional staffing requirements (medical assistant) are anticipated.

Surveillance	Enrollment	Regulatory Drivers	Summary of Surveillance Components	SUOHC Observations
			(all components of medical surveillance are not listed)	



STANFORD UNIVERSITY

Bloodborne Pathogens (BBP)	HCW's, research personnel working with human blood/OPIM, Public Safety	Title 8, California Code of Regulations, Section 5193	HBV Consent/Declination Form HBV Vaccination (0,1,6 months) and post-vaccination titer verification	SUOHC does not currently receive list of all university personnel enrolled in program, nor do we receive BBP declaration/declination forms. These are currently maintained by individual department.
Occupational Noise - Hearing Conservation Program	CM cagewashers, Grounds, Facilities, R&DE,	Title 8, California Code of Regulations, Section 5098	Baseline Medical Evaluation and Audiogram. Annual audiogram.	A number of Facilities employees enrolled in HCP are having surveillance performed by outside vendor
Laser	Research and HCW personnel working with Class 3B and 4 lasers	ANSI Standard Z136.1-2000 (Appendix E)	Baseline eye exam. Referral for dilated eye exam and fundus photos for those who have abnormal baseline exam	Those with an abnormal screening exam at SUOHC are referred to PAMF for comprehensive exam.
Respiratory Protection	R&DE, Facilities, Public Safety, EH&S, Comparative Medicine, and HCW personnel	Title 8, California Code of Regulations, Section 5144	Baseline and annual OSHA respirator medical questionnaire. Baseline medical exam and PFT. Annual exam only if change in medical condition	Medical student clearances to be performed by SUOHC beginning 2011
HAZWOPER	EH&S personnel	Title 8, California Code of Regulations, Section 5194	Baseline and annual PE. Annual PFT Annual Screening labs	
Health Care Worker	Stanford Blood Center SPECTRUM Vaden/SUOHC/SLAC OHC Medical Students	Title 8, California Code of Regulations, Section 5199 (ATD Standard)	Verification of vaccination or immunity to MMR, VZV, Tdap. HBV Consent/Declination Form HBV Vaccination Baseline and annual TB screening	SUOHC is noting increasing volume of required med surveillance for this group
Daycare/Preschool Worker	Bing Nursery teachers and admin staff	California Health and Safety Code (121525-121555) and California Education Code Section (49406)	TB screening at hire and q4 years	Currently not performing
Public Safety Police Officers		Title 8, California Code of Regulations, Section 5199 (ATD Standard)	Baseline & annual QFT; respirator clearance and baseline PFT; annual fit-testing; annual flu vaccination	Currently performing baseline PE and evaluation at PAMF
DOT	Facilities		DMV Exam (Class A&C) every 2 years Drug screening	Facilities employees currently using U.S. Healthworks
LAOHP - Non-Human Primate	CM personnel; Researchers	CFR 1984a,b,c; PHS Policy	Baseline medical counseling re. B-Virus. Baseline and annual TB screening.	
LAOHP - RC1 (other) Female Sheep Male Sheep Wild Animals	CM researchers	CFR 1984a,b,c; PHS Policy	LAOHP Medical Questionnaire Baseline targeted medical exam and counseling. Baseline Coxiella Titer Rabies Vaccination if indicated for wild animals	

(continued on next page)

(continued from previous page)

Surveillance	Enrollment	Regulatory	Summary of Surveillance	SUOHC
--------------	------------	------------	-------------------------	-------



STANFORD UNIVERSITY

		Drivers	Components <small>(all components of medical surveillance are not listed)</small>	Observations
LAOHP – RC2 Rodents	CM personnel; researchers	CFR 1984a,b,c; PHS Policy	LAOHP Medical Questionnaire Medical evaluation only for those with positive screen	See allergy section below. Surveillance is currently optional for this group. Significant numbers of researchers with lab animal allergy development are being observed.
Comparative Medicine (Vet, Vet tech, Animal Care Worker, Cage Washer)	All CM personnel	CFR 1984a,b,c; PHS Policy	Baseline medical eval Baseline PFT and respir clearance. Baseline and annual TB screening	
Biological Agents (Toxoplasma gondii; Schistosoma; Coxiella; Influenza; Dengue; Yellow Fever; Rabies virus; Vaccinia virus; Wild-type Polio virus; Varicella; Rubeola; Rubella; MTB;	Researchers	Title 8, California Code of Regulations, Sections 5192, 5199	As indicated for specific agent. Vaccination for vaccine-preventable dz's	Increasing numbers of protocols are being submitted to APB for use of biological agents. Many require baseline medical surveillance at SUOHC.
Chemical Agents (MPTP; Select Agents; Diptheria toxin; Formaldehyde; Carcinogens; Hazardous Chemicals in Laboratories; Pesticides; Lead	Researchers Grounds	Title 8, California Code of Regulations, Sections 5191, 5217, 5209	As indicated by specific agent	Researchers using select agents are not currently being followed with surveillance
Asbestos	None at present	Title 8, California Code of Regulations, Section 5208		
Allergy		CFR 1984a,b,c; PHS Policy	Allergy Medical Evaluation; Baseline and q3 year PFT. Respirator clearance and fit-testing. Annual f/u evaluation	A significant increase in incidence of LAA due to rodent handling in graduate students, postdocs, and researchers has been observed at SU in last 3 years. Multiple labs are contaminated with rodent allergens due to haphazard use and storage of rodents in labs. Inadequate fume hoods in many areas where rodents are use.
Nanomaterials	None at present			

Medical Records Management

Stanford University Occupational Health Center protects the confidentiality of patient health information (PHI) in



STANFORD UNIVERSITY

accordance with the federal Health Insurance Portability and Accountability Act of 1996 (HIPAA) as well as with other federal, state, and Stanford University laws and regulations. The SUOHC's Notice of Privacy Practices describes how medical information may be used and disclosed, and how personnel treated in SUOHC may access their medical information.

Electronic Medical Record (EMR)

SUOHC utilizes Medgate EMR for the Occupation Medicine Program. This is a web-based EMR. Stanford University personnel who undergo evaluation at SUOHC have an individual EMR: this record contains medically confidential information (e.g., health history, exposure history, demographic data, and all medical documentation for medical surveillance, immunization, and injury/illness care), which is only released according to prescribed law. All medical records maintained by SUOHC are kept in a confidential manner, protected from unauthorized access, and stored under conditions that ensure their long-term preservation. To the extent possible, SUOHC maintains its records in accordance with Executive Order 13335, Incentives for the Use of Health Information Technology. EH&S and University IT provides EMR program support and oversees security assurance. Direct vendor support is also utilized. University personnel are informed of the purpose, nature, and results of medical evaluations and tests done for them by SUOHC clinicians and staff members. The results of all tests and evaluations, and communications with the patient, are recorded in the patient's health record. Employee Assistance Program psychological records are not maintained by SUOHC. These records are maintained separately by the Stanford University HelpCenter office.

Cal/OSHA Sharps Injury Log and 300 log

SUOHC maintains the required Sharps Injury Log. Currently, Risk Management maintains the OSHA 300 Log. SUOHC staff lends support to this task through the timely and accurate provision of injury/illness data and work status reports.

Future Needs / Challenges

SUOHC needs to re-evaluate our current EMR in the next 6 months to determine overall effectiveness and cost/benefit of

this product. If Medgate is deemed to be the best match for our ongoing programmatic needs, then an extensive program update will be required for continued Medgate use in the next 12 months. If a superior EMR option is determined, and a cost-benefit analysis determines a favorable advantage for use of that system, then we will need to navigate to that EMR in the next 12 months. A single EMR needs to be used at SUOHC and SLAC OHC. Medgate is not currently certified by DOD/DOE for use in DOE facility.

All medical documents for medical surveillance (such as vaccine consent or declination forms) need to be stored by SUOHC in the employee's EMR. In the past, many of these forms have been maintained by the individual's department. We are therefore unable to assure that medical records are being maintained and stored in compliance with state and federal law.

SUOHC website redesign will be necessary in the next 12 months. In addition, SUOHC will need to assume the primary role of maintaining the Cal/OSHA 300 Log in the next 6-12 months.

Medical Case Management and Return-to-Work Program Support

SUOHC clinic staff provides medical case management and return-to-work support for employees who have industrial injuries and illnesses. This includes coordinating and scheduling offsite services (diagnostic studies or specialist consultations), communicating with WC claims managers and Utilization Review to obtain authorizations for requested care, and communicating with department managers to facilitate early return to work. Our goal is to minimize wasted time in obtaining necessary diagnostic evaluation and treatment for injured personnel, and to facilitate the return of employees to work as soon as is safely possible after an industrial injury or illness. The Return-to-Work process helps to reduce unnecessary lost work time by providing injured employees modified work until they can resume full activity. Objectives include: 1) Support employees in their recovery from

injury or illness by providing temporary modified work assignments; 2) Minimize the duration of absence and the resulting impact to both the employee and Stanford University due to work-related injuries and illnesses; and 3) Reduce Workers' Compensation disability costs, as well as indirect organization costs due to loss of productivity.

Temporary Accommodation of Work-related injuries / illnesses

If work restrictions for an employee are deemed necessary by the clinical staff at SUOHC, the work status report conveying specific work restrictions is communicated with the employee's supervisor and HR manager. The Return to Work Coordinator is also notified. The employee's manager and HR representative will identify temporary work assignments for up to 90-calendar days for employees with temporary medical restrictions caused by industrial injury or illness. If no accommodation can be found, then the employee is sent home on total temporary disability (TTD).

Detailed Job Analysis

Detailed job analysis for employees who have been on TTD for > 30 days are performed by the Return to Work Coordinator, and are provided to clinical staff at SUOHC for review. This often allows for more specific and narrow work restrictions, which can in turn facilitate temporary accommodation of the employee by his or her department.

Future Needs / Challenges

There continues to be poor acceptance of work restrictions by a number of key departments at Stanford University. Buy-in by university leadership will be necessary to change this in a favorable manner. SUOHC staff will need to work more closely with EH&S leadership and Risk Management to develop a strategy to further address this concern.

Wellness / Prevention Services

Stanford University has a well established program (BeWell) to promote and maintain the physical and mental health of employees on the job and at home. This program focuses on primary and secondary prevention, and utilizes health education, health promotion, and healthy lifestyle



intervention programs on campus. The program is designed to reduce preventable disease and improve control of chronic health conditions in employees, thereby helping employees to avoid absences from work due to illness and improve employee effectiveness on the job. Services include a personal health risk assessment, lipid and BP screening and counseling, body fat and BMI screen and weight management counseling, smoking cessation, cardiovascular fitness, healthy eating, and stress management. Health promotion works in a complementary manner with worksite safety programs to reduce the risk of work-related injuries and to reduce health-related costs to the employees and for the institution as a whole. SUOHC partners with BeWell to a limited extent in this effort.

Program Elements

Flu Vaccination

SUOHC has established an annual campus-wide seasonal influenza vaccination program. Funding for this effort has been obtained through Benefits. SUOHC coordinates with Vaden Student Health to deliver flu vaccinations to students, faculty, and staff at multiple locations and times across campus. SUOHC has delivered approximately 4000 annual influenza vaccinations to faculty and staff, retirees, and postdoctoral scholars during the 2010 and 2011 flu seasons.

BeWell during patient visits

SUOHC is attempting to use any patient encounter as an opportunity to also briefly discuss general health prevention and participation in BeWell programs.

Automatic External Defibrillator (AED) Program (Medical Oversight)

Stanford University currently has an Automated External Defibrillator (AED) program which is managed by EH&S. Regulatory oversight of this program is governed by California Code of Regulations, Title 22, Division 9, Chapter 1.8, and Health and Safety Code Section 1797.190. EH&S personnel work with departments that wish to implement an AED program in their specific work area. The Occupational Health Center Medical

Director serves as Medical Director for the university's AED program, and ensures that university "Lay Rescuers" receive and maintain CPR and AED training that meets American Heart Association and American Red Cross standards. Training of individuals in CPR and AED use increases the probability that an AED will be used in the event of a witnessed cardiac arrest, and increases the probability of a successful resuscitation effort. The training requirement for AEDs is based on California statute, which mandates that for every AED unit up to the first five units acquired by Stanford University, no less than one Lay Rescuer per AED shall receive and maintain adequate CPR/AED training. Thereafter, for every one additional AED unit acquired by Stanford University, one additional Lay Rescuer per 5 AEDs shall receive and maintain adequate CPR/AED training. Currently, there are 34 AED Coordinators in various departments at Stanford University and over 280 lay rescuers who are current in their CPR and AED training requirement. Additionally, California Health Code requires that the Medical Director reviews each incident where emergency care or treatment on a person in cardiac arrest is rendered by a lay rescuer at Stanford University.

Future Needs / Challenges

To maximize the effectiveness of AED Programs, the AHA has emphasized the importance of organizing, planning, training, linking with the EMS system, and establishing a process of continuous quality improvement. According to the AHA, sites without these components are unlikely to demonstrate any improvement in survival rates for out-of-hospital witnessed sudden cardiac arrest (SCA). The mere presence of an AED does not ensure that it will be used when SCA occurs. In fact, in the Public Access Defibrillator (PAD) Trial, lay rescuers with appropriate CPR/AED training used an AED in only 34% of SCA cases when an AED was readily available. This suggests that lay rescuers need frequent practice to optimize response in emergencies. To that effect, the Occupational Medicine Program at Stanford University will plan to initiate a periodic "hands-on" training drill for all university lay rescuers once yearly. This program should be initiated within the next 12-18 months.

Education / Teaching Activity

The occupational health clinics at Stanford University and SLAC offer an ideal setting to provide targeted medical education of core concepts in occupational and environmental health to: Medical students enrolled at Stanford University School of Medicine, Physician Assistant students enrolled in the Foothill College/Stanford University program, Nurse Practitioner students enrolled in the UCSF Occupational Health program, and Residents-in-training at SHC. The medical directors of the occupational medicine program at Stanford University and SLAC are faculty physicians in the Clinical-Educator Line, and teaching duty is a core requirement for maintenance and advancement of their academic appointments. To date, the medical directors have served as preceptors for NP students from the UCSF Occupational Health Program. Lectures have been given to medical students and PA students. Direct hands-on teaching has been provided to medical students in a limited capacity.

Future Needs / Challenges

The teaching component will need to be further developed, with an increasing proportion of the physician's time spent in teaching functions. This will be further developed with the Division Chief and with the Associate Vice Provost of EH&S.

SLAC Site Operations

Background

Since assuming medical care at SLAC in October 2010, the on-site Occupational Health Center (OHC) has provided comprehensive occupational medical services to over 1500 full-time SLAC employees, including those who are enrolled in a medical or exposure monitoring program as required by any applicable federal, state, or local regulation, or other obligation.

Medical evaluations provided by the OHC ensure that a worker meets specific physical, medical, and psychological requirements for a given position. SLAC OHC provides hazards-based medical monitoring (i.e., beryllium, lead, bloodborne pathogens) and qualifications-based medical certification exams as



required by standards and regulations, as supported by on-site industrial hygiene monitoring. Physical examinations / evaluations are conducted for job pre-placement, new hires, job transfers, specific work areas, and employment termination. Additionally, medical examinations/evaluations are performed to certify employees for certain work activities, personal protective equipment (PPE) or for medical surveillance to monitor for health effects.

Medical Surveillance Examinations

As listed in the SLAC training assessment database at time of analysis (November 10, 2011), there are over 450 different employees and users listed under over 650 surveillance examinations, with approximately 25% of these workers enrolled in more than one examination. The number of employees and users registered in the programs are listed below:

Table with 2 columns: Program, Users. Lists programs like Beryllium, Bloodborne Pathogens, Crane Operators, etc., with corresponding user counts.

Beryllium Workers

The purpose of the SLAC Chronic Beryllium Disease Prevention Program is to meet the requirements of Title 10, Code of Federal Regulations, "Energy", Chapter 3, "Department of Energy", Part 850, "Chronic Beryllium Disease Prevention Program" (10 CFR 850). From a medical perspective, this is performed through provision of medical monitoring and surveillance of workers potentially exposed to beryllium and through coordination with industrial hygiene regarding job-specific safety procedures for legacy beryllium use.

evaluation. Baseline medical evaluations must include: A detailed medical and work history with emphasis on past, present, and anticipated future exposure to beryllium; A respiratory symptoms questionnaire; A physical examination with special emphasis on the respiratory system, skin and eyes; A chest radiograph (posterior anterior, 14 x 17 inches) interpreted by a National Institute for Occupational Safety and Health (NIOSH) B-reader of pneumoconiosis or a board-certified radiologist (unless a baseline chest radiograph is already on file); Spirometry consisting of forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV1); A Be-LPT; and Any other tests deemed appropriate by the examining physician for evaluating beryllium-related health effects. Periodic evaluations must include: A detailed medical and work history with emphasis on past, present, and anticipated future exposure to beryllium; A respiratory symptoms questionnaire; A physical examination with emphasis on the respiratory system; A Be-LPT; and Any other medical evaluations deemed appropriate by the examining physician for evaluating beryllium-related health effects.

Bloodborne Pathogens

As per Title 29, Code of Federal Regulations, Part 1910.1030, "Occupational Exposure to Bloodborne Pathogens" (29 CFR 1910.1030), the employer shall make available the hepatitis B vaccine and vaccination series to all employees who have occupational exposure, and post-exposure evaluation and follow-up to all employees who have had an exposure incident. Occupational Exposure means reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials that may result from the performance of an employee's duties. There are currently 28 employees enrolled in the Bloodborne pathogens medical surveillance program at SLAC. This number requiring medical examination will increase in FY2012 as SLAC itself is in the process of transferring away from on-site Firefighter and Paramedic coverage

through the City of Palo Alto and will consequently be increasing the capabilities and size of the on-site SLAC emergency response team (SERT). Specific requirements of this program, in addition to annual training, include offering and providing Hepatitis B vaccination to employees who are determined to have occupational exposure to blood or other potentially infectious materials. The direct costs associated with this will consist of immunization supplies and titer testing for the at-risk workforce that will request Hepatitis B vaccination. In addition to the above, SLAC injury reporting requirements follow these standards: Title 8, California Code of Regulations, Section 5193, "Bloodborne Pathogens", (8 CCR 5193) for sharps injuries.

Crane Operators

The SLAC hoisting and rigging program follows Department of Energy Standard 1090, "Hoisting and Rigging" (DOE-STD-1090-2007), which compiles hoisting and rigging codes, standards, and regulations. Operators of cab-operated, pulpit-operated, or mobile cranes must successfully complete a medical surveillance program in compliance with an accredited certifying entity. Title 8, California Code of Regulations, 8 CCR 5006 and 8 CCR 5006.1 dictate that a Mobile Crane and Tower Crane operator must pass a physical examination conducted by a physician which at a minimum shall include the examination criteria specified in the American Society of Mechanical Engineers (ASME) B30.5-2000 standard, Chapter 5-3.1.2(a)(1-5, 7, 8) or the U.S. Department of Transportation (US DOT) physical examination requirements contained in 49 CFR Sections 391.41 through 391.49. These operators must additionally pass a substance abuse test. The level of testing shall be consistent with the standard practice for the industry where the crane is in use and this test shall be conducted by a recognized laboratory service. There are currently 12 employees enrolled in this medical examination at SLAC, and the SLAC medical provider is collaborating with HR and legal to bring this examination process in line with DOE recommendations and CAL/OSHA and ANSI standards. As noted above, this will involve performance of substance abuse testing as well DOT examinations on a periodic basis for these employees.



HAZWOPER

As detailed in [29 CFR 1910.120](#), employees engaged in operations within this standard shall undergo medical surveillance. This includes the following: All employees who are or may be exposed to hazardous substances or health hazards at or above the established permissible exposure limit, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more a year; All employees who wear a respirator for 30 days or more a year or as required by 1910.134; All employees who are injured, become ill or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operation; and Members of HAZMAT teams. There are currently 17 employees enrolled in the HAZWOPER medical surveillance program at SLAC, largely due to their involvement on HAZMAT teams. Medical Surveillance is required at the following time intervals: (1) Initial program entry; (2) Annually; (3) At exit from program or employment; (4) Periodically (after any stated exposure or employee concern about health issue related to HAZMAT response work). These medical examinations include a medical and work history with special emphasis on symptoms related to the handling of hazardous substances and health hazards, and notation of fitness for duty, including the ability to wear any required PPE under conditions that may be expected at the work site. Following the exam, a mandatory "Physician's Written Opinion" is provided to each employee and employer, with the purpose of listing clearance or restrictions for continued Hazmat Response work as well as the presence or absence of any medical conditions due to this work. Testing may include: 1) Physical examination, 2) Blood pressure measurement, 3) Visual acuity monitoring, 4) Audiometric testing, 5) Pulmonary function testing/spirometry, 6) EKG testing, 7) Blood and urine testing (CBC, Comp Metabolic Panel, U/A, Blood lead and ZPP), and 8) Chest x-ray performance.

Hearing

The OSHA Occupational Noise Exposure section of the Safety and Health Standards, [29 CFR 1910.95](#), details the need for baseline and annual testing for each

employee exposed at or above an 8-hour time-weighted average of 85 decibels. There are currently 172 employees at SLAC enrolled in the hearing conservation program. Given that nearly 10% of the SLAC campus is currently enrolled in this hearing conservation program, the SLAC industrial hygiene team has increased performance of personal dosimetry in an effort to better classify those employees who need to be surveilled under this guideline. The expectation is that the number of employees who present annually for audiometric testing and subsequent physician counseling will reduce in the upcoming years.

Laser

There are currently 250 total workers (173 employees/77 users) enrolled in the laser surveillance program, which serves to screen and counsel workers prior to work around or with Class III-IV lasers. The ANSI laser standard (ANSI Z136.1) is a consensus standard that provides guidelines for the safe use of lasers to be adopted voluntarily by users. OSHA does not require compliance with this standard, though OSHA auditors can issue citations for violations of the standard. The DOE adopts a more rigorous policy with Rule 10 CFR 851 requiring DOE contractors and subcontractors to comply with the ANSI laser standard. Consequently, at SLAC this exam is mandatory for personnel who operate Class 3B or Class 4 lasers and is required following any suspected laser-induced injury. A voluntary 253ME exit exam is offered to SLAC employees upon termination of employment. Although this exam is performed as a one-time clearance exam with no mandated annual requirement, due to the increase in user population on-site performing time-limited research projects, there were 111 laser exams performed at SLAC in FY 2011. The medical components of the examination include a review of ocular history, a visual acuity test, an Amsler grid test, and a color vision test. If testing reveals an abnormality, an additional referral to an ophthalmologist for dilated fundoscopic exam may be required.

Lead

The Occupational Safety and Health Lead Standard, [29 CFR 1910.1025](#), states that the employer shall institute a medical surveillance program for all employees who are or may be exposed at or above the

action level for more than 30 days per year, namely to an airborne concentration of lead of 30 micrograms per cubic meter of air (30 ug/m³) averaged over an 8-hour period. SLAC currently is in the process of significant lead handling activities throughout the site, with on-going removal of thousands of tons of legacy and unused lead shielding materials. At this time, there are over 50 SLAC employees currently enrolled in the lead surveillance program, most notably those who handle lead bricks and sheet and those who perform specialized work, such as welding or machining of materials containing lead. Although OSHA Guidelines have remained largely unchanged since their time of adoption, multiple State and Federal agencies have weighed in on this topic and have recommended more stringent surveillance to protect workers with potential risk. The U.S. Centers for Disease Control and Prevention (CDC) in 1997 changed its childhood lead poisoning surveillance guidelines to characterize a normal blood lead level (BLL) as less than 9 mcg/dL. More recently published studies have demonstrated decrements in cognitive scores when BLL averaged more than 5 mcg/dL in children and more than 10 mcg/dL in adults. In an effort to further promote safety in the workplace and at home, based upon the above information, SLAC OHC is updating its medical surveillance protocol in alignment with best practice and scientific evidence. Current lead examination procedures include questionnaire completion, blood pressure monitoring, physical examination, CBC and lead/ZPP blood testing, and urinalysis obtainment, with frequency of surveillance typically annually, dependent on workplace lead exposure and blood levels.

Nanoparticle

In compliance with the SLAC Nanoscale Material Safety Plan, and in line with Department of Energy Policy 456.1, SLAC OHC performs medical surveillance examinations for those workers identified as nanoparticle workers: 1) Workers who handle nanoscale particulates that have the potential to become dispersed with the potential for inhalation or dermal contact; 2) Workers who routinely spend significant amounts of time in an area in which nanoparticles have the potential to become dispersed in the air; and 3) Workers who operate or work on equipment that is believed to be



contaminated and could foreseeably release engineered nanoparticles during servicing or maintenance. There are currently 13 SLAC employees identified as nanoparticle workers. As per the current guidelines, these employees are offered a baseline medical evaluation consisting of a general history and physical exam, including general blood work, pulmonary function testing, and other tests (including chest x-ray imaging) determined by the SLAC Medical Department based upon health history and other associated risks. Given the anticipated rise in both employee and user participation in nanoparticle research, an increase in clinic visits is expected in the upcoming fiscal years.

Respirator, Welding, Plating Shop

As per OSHA [29 CFR 1910.134](#), and in accordance with [SLAC policy](#), all SLAC personnel working in a designated respirator use area, or who are otherwise required to wear a respirator as a part of their job, must first obtain required the medical evaluation and clearance before doing the practical fit test and wearing a respirator. These evaluations occur in the form of questionnaire review, physical examination, and pulmonary function testing. While this program more globally involves a group of 67 employees throughout SLAC (as determined by the industrial hygienist), this surveillance group also includes 14 welders and 8 plating shop employees who additionally undergo blood and urinary monitoring tailored to their potential on-site exposures.

Injury Evaluations

As outlined in Appendix A to Part 851—Worker Safety and Health Functional Areas, Section 8: Occupational Medicine, the designated occupational medicine provider must plan and implement the occupation medicine services. SLAC OHC provides first-aid and medical treatment and monitors the health status of workers who have experienced occupational illness or injury in order to facilitate their rehabilitation and safe return to work. SLAC OHC also provides diagnostic and medical management services for work-related (occupational) illnesses and injuries. For non-work related conditions, SLAC OHC provides limited first-aid treatment and emergency triage to minimize lost time and its associated costs. SLAC OHC clinicians, on a timely basis,

communicate results of health evaluations to management and safety and health protection specialists to facilitate the mitigation of worksite hazards. Since assuming medical operations at SLAC in October 2010, SLAC OHC has observed an overall steady rise in the total number of patients who present for injury evaluation, whether industrial or non-industrial. This increased has also coincided with the enhancement of the campus ergonomic presence as referenced above. Due to continued expanding ergonomic outreach and SLAC OHC outreach and education, however, this increase is expected to continue through the upcoming fiscal year.

Return-to-Work Evaluations

The SLAC OHC Return to Work Program provides a system for returning employees to work as soon as is safely possible after an injury or illness. The Return to Work Program helps to reduce lost work time and manage injury/illness cases by giving injured employees modified work until they can resume full activity. The program covers both work- and non-work-related illnesses and injuries that result in medical restrictions or lost work time. The objectives of the Return to Work Program include: 1) Support employees in their recovery from injury or illness by providing temporary, modified, or alternate assignment recommendations; 2) Minimize the duration of absence, as well as the resulting impact to both the employee and the organization, due to work- or non-work-related injuries and illnesses; 3) Reduce workers' compensation and related overhead disability costs; and 4) Identify and effectively manage potential long-term or permanent disability cases. As detailed in [Appendix A to Part 851](#)—Worker Safety and Health Functional Areas, Section 8: Occupational Medicine, DOE mandates that all employees with a work-related injury or illness or an absence due to any injury or illness lasting 5 or more consecutive workdays (or an equivalent time period for those individuals on an alternative work schedule), obtain medical clearance through SLAC OHC attesting to the individual's physical and psychological capacity to return to work (RTW). To further protect the safety of the SLAC work environment, and in line with a similar policy at LLNL, SLAC OHC utilizes these criteria to determine which employees require return to work examination: Following a work-related injury or illness involving 1 or more lost

workdays treated outside of SLAC OHC; Following a non-work-related injury or illness of 5 or more consecutive workdays (or an equivalent time period for individuals on alternate work schedules); Following a non-work-related injury or illness requiring hospitalization or surgery; and Following provision of a medical restriction issued by their personal physician. Based upon the evaluation performed, the SLAC OHC provider will determine the individual's physical and psychological capacity to perform work and return to duty, issuing a return-to-work clearance, with or without medical restrictions.

Wellness Exams and Physicals

As per the SLAC [Environmental, Health, and Safety Manual](#), the on-site medical manages SLAC's health and wellness program, including evaluation of worker health statistics and trends, and designing programs to manage preventable health and illness issues. To promote and maintain the physical and mental health of employees both on the job and at home, SLAC OHC offers health education, health promotion, and healthy lifestyle intervention. This education is designed to reduce preventable disease, help employees avoid disease-related work absences, and improve employee effectiveness on the job. Included are services to assist employees with personal health risk assessment, lipids and blood pressure management, smoking cessation, cardiovascular fitness, healthy eating, and stress management. SLAC OHC also provides other time-saving services onsite, including cholesterol screening and flu vaccination. As a general rule, SLAC OHC provides initial and periodic physicals on request to all full-time SLAC employees at time of hire, every 5 years, and at time of exit from employment at SLAC. This is expounded in DOE [10 CFR 851](#) where the performance of health evaluations must be conducted when determined necessary by the occupational medicine provider for the purpose of providing initial and continuing assessment of employee fitness for duty: 1) At the time of employment entrance or transfer to a job with new functions and hazards; 2) Periodically, with hazard-based medical monitoring or qualification-based fitness for duty evaluations; and 3) At the time of separation from employment. Based upon encouragement of wellness exam participation, and considering the levels of employee participation in



voluntary initial and periodic examinations, including as prompted through the Stanford BeWell program, SLAC OHC expects the volume of examinations to continue to rise in the upcoming fiscal year.

Ergonomics

SLAC complies with DOE edicts and produces Performance Evaluation and Measurement Plan (PEMP) goals yearly on a broader facility level. The overall SLAC Safety and Health agenda for fiscal year 2012 focuses on strategic planning as it pertains to ergonomics injury prevention, and the SLAC Environmental Safety and Health business plan promulgates a facility-wide operations agenda that includes an ergonomics injury prevention program to reduce the frequency and severity of ergonomically-related injuries and illnesses, most notably while SLAC relocates a majority of staff over the next few years. In light of this highly visible DOE agenda item, and in an effort to be more proactive than reactive in mitigating both industrial and office-based ergonomic injury, SLAC ES&H has begun to more formally develop their on-site ergonomics program and continues to seek support from SU EH&S for expanded ergonomics services and special initiatives. These include, but are not limited, to the following:

- Provision of office ergonomic evaluation services for preventive and injury-triggered cases. Total projections based on data below indicate upwards of 388 evaluations in the next 12-month period; Based on OHC records since the recruitment of the summer hire in July 2011, the monthly average demand for preventive and injury-triggered

evaluations has been 24 per month. According to SLAC ES&H, approximately 100 evaluations will be expected in connection with office moves in the next 12-month period. Continuing to implement a process for all new employees and those with recent workstation moves to undergo online training as well as workstation self-evaluation, emphasizing employee awareness of recommended workstation setup and safe work practices.

- Developing a SLAC-approved ergonomics equipment catalog and the associated ergonomic equipment partial reimbursement program.
- Developing and maintaining a showroom for employees to test pre-approved products, coordinating with vendors and training staff to assist employees with selecting these products.
- Developing and implementing a process to identify non-office (e.g. laboratory) operations at SLAC that would benefit from ergonomic risk assessment and coordinating with an outside agency to perform such assessments.
- Updating the SLAC Ergonomics Program website and develop tools and process to post on this website. This includes self-assessment tips, keyboard commands, and tips on safe lifting/handling, laptop and laboratory ergonomics.
- Review of the web-based Course # 291 – Ergonomics Training – Office Worker and assisting with efforts to provide a web-based version of Course 410 – Back Safety.
- Development of an electronic ergonomic evaluation database to allow OHC to more efficiently maintain and distribute its evaluation findings/

recommendations, and semi-automate the evaluation follow-up process.

To provide for ongoing development and implementation of an institutional ergonomics program at SLAC, a staffing level which includes a certified professional ergonomist and a field ergonomics has been adopted for the 2012 fiscal year. The ***Certified Professional Ergonomist (CPE)*** (0.15 FTE) provides: Ongoing management of overall ergonomics service provision: Supervision of on-site ergonomist, Consultation/ planning for institutional ergonomic preventive efforts, Oversight of development of formal ergonomics program, Ergonomic assessment of non-office workplace operations (i.e., manual handling, laboratory), and Provision of supplemental live-training. The ***Field Ergonomist*** (0.8 FTE) provides: Field ergonomic evaluations, Development and implementation of ergonomic program components, Consult on workplace ergonomic equipment needs, Workplace training support, On-going training of OHC medical assistants for common ergonomic service demands, and Longer term, where special projects (i.e., large volume office move consultation/ training) may require supplemental field support, additional temporary staffing demands may need to be explored w/ SLAC. Both the field ergonomist and the CPE work directly with employees experiencing discomfort at their worksite to help minimize future discomfort and thwart injury onset, providing enhanced education on ergonomics and other related health issues, posture, body mechanics, and activities of daily living.



Clinical Radiation
Ionizing Radiation
Non-Ionizing Radiation
Laser Safety
Radioactive Drugs



Health Physics

The Radiation Safety program is responsible for ensuring the safe use of radioactive materials and radiation sources at all of Stanford University facilities, at both Stanford Hospital and Lucille Packard Children's Hospital, through a memorandum of understanding, and at the Veterans Affairs Palo Alto Health Care System via contract. Radiation Safety maintains radioactive material licenses/permits with the 1) State of California Department of Health Services for both the University and the associated medical centers, and 2) Nuclear Regulatory Commission for the VAPAHCS via the Veterans Affairs National Health Physics Program.

Supports these University Units:	Technical Services Provided	Business Drivers
<ul style="list-style-type: none"> • Research Laboratories • Stanford Hospital and Lucille Packard Children's Hospital • Veterans Affairs Palo Alto Health Care System • Radiochemistry facilities • Research Committees • Construction / Renovation 	<ul style="list-style-type: none"> • Licensing, Registration, and Authorizations • Administrative Panel Support • Exposure Monitoring • Contamination surveys / leak tests and Emergency Response • Facility Plan Reviews and Decommissioning • Laser Safety • Human Subjects • Deliveries and Shipments • Training 	<ul style="list-style-type: none"> • Radioactive materials research (including clinical drugs) • Radioisotope production • Spills and Releases • Institutional regulatory compliance • New Construction and Remodeling • Facility Usage (including radiochemistry) • Laser use



University's Emerging Health Physics Needs

Cyclotron and Radiochemistry facilities

The cyclotron with its PE isotope production and radiochemistry facilities continue to place a significant stress on Health Physics resources. The increased use of PE isotopes in the research facilities, hospital and the Cancer Center has also stressed our resources. There is also a potential of a second “table top” cyclotron at the new Porter Avenue location. The new Porter Avenue location will house additional PE isotope radiochemistry facilities. If there is not a second cyclotron at Porter Avenue then isotope from the current cyclotron will be transported there daily. The associated laboratories will house “Hot Cells” similar to that at the current cyclotron facility and require special ventilation systems, effluent monitoring, license amendments and radiation monitoring.

Radioisotope production

Radiology is still considering amending the current radioactive material license to allow limited commercial distribution to the VAPAHCS. Currently, the VAPAHCS receives their PE isotope from PETNET but that facility may be closing in the year.

New facilities, renovations, and moves

New clinical facility designs and remodels of Nuclear Medicine, Radiology, Cardiac Cathardization, Surgery, Endoscopy, etc. require shielding designs, OSHPOD approvals, and shielding verification surveys. More facilities both research and clinical have moved offsite, such as, research facilities on Porter Avenue and potentially Redwood City and clinical facilities on Sherman Avenue and in Redwood City. Travel time to and from these facilities leads to the need for more person-hours. Fortunately, none of these

future developments should require an increase in our facility space needs.

PROGRAM NEEDS

Health Physics

- Resources to support the cyclotron and increased use of PE isotopes in the research facilities, hospital, and Cancer Center.
- Second cyclotron at the new Porter Avenue location (to reduce isotope transport)
- Radioactive material license amendment to allow commercial distribution
- New facilities and renovations
- Movement of facilities to off-site locations

Program Elements

Overview

Licensing Registration and Authorizations	Administrative Panel Support Committee Support	Exposure Monitoring	Contamination Surveys / Tests and Emergency Response	Facility Plan Reviews and Decommissioning
<ol style="list-style-type: none"> Licensing and Registration Regulatory Affairs Authorizations and Audits 	<ol style="list-style-type: none"> Administrative Panel on Radiological Safety Clinical Radiation Safety Committee Radioactive Drug Research Committee Non-Human use Radiation Safety Committee Laser Safety Committee Administrative Panel on Human Subjects 	<ol style="list-style-type: none"> Dosimetry Bioassays Thyroid Monitoring 	<ol style="list-style-type: none"> Environmental monitoring (releases) Laboratory surveys and oversight Sealed source leak tests Emergency Response Instrument Calibration 	<ol style="list-style-type: none"> Plan Reviews Decommissioning

Radioisotope Production	Human Subjects and Clinical Patients	Delivery and Shipments of Radioisotopes	Training	Laser Safety and Non-Ionizing Radiation
<ol style="list-style-type: none"> Clinical Isotope Production Research Isotope Production 	<ol style="list-style-type: none"> Human Clinical Use Human Research Use 	<ol style="list-style-type: none"> Deliveries of radioactive materials Shipments of Dangerous Goods 	<ol style="list-style-type: none"> Training material development Classroom courses Online courses 	<ol style="list-style-type: none"> Laser Safety Non-Ionizing Radiation (UV, IR, and Electromagnetic)



Licensing, Registration, and Authorizations

Purpose	Enable and protect the ability to use radioactive materials in research and clinical activities ; Coordinate compliance inspections ; Approve use of ionizing radiation .
Program Elements	Licensing and Registration Regulatory Affairs Authorizations and Audits (Hazard Evaluations and Controls, Audits, Compliance Reviews)
Business Drivers	<ul style="list-style-type: none"> • Department of Public Health and U.S. Department of Veterans Affairs • Regulatory inspections • Controlled Radiation Authorizations (CRAs)

Licensing and Registration

(Regulatory Drivers: 17 CFR 30108/196, 10 CFR 20, 30, 40, 70)

The Health Physics Office is responsible for maintaining current the radioactive materials license issued by the California Department of Public Health, Radiologic Health Branch (DPH/RHB) that permits the possession and use of radioactive materials in research and clinical and patient care activities. The license includes the University (including Hopkins Marine Station), Stanford University Hospital and Packard Children's Hospital and the Carnegie Institution of Washington (Plant Biology) as authorized places of use. The Manager of Health Physics, who is the Radiation Safety Officer (RSO), is responsible for amending the license to accommodate changes in usage and/or regulations, and for submitting applications for timely renewal of the license and for negotiating with the agency DPH/RHB to incorporate appropriate procedures. The RSO executes applications in the name of the Board of Trustees of the University and the management of the other institutions specified in the license.

Additionally, Health Physics registers all machines that produce significant levels of ionizing radiation, e.g., X-ray machines, accelerators, and similar devices, with the DOHS/RHB in the name of the Board of Trustees and/or Stanford Healthcare. Clerical efforts are devoted to the registration process and to maintaining license and registration files. In addition Stanford must furnish and obtain and maintain copies of licenses from other institutions when materials are obtained from, or shipped to, off-campus locations.

Also, Health Physics has a contractual arrangement with the U.S. Department of Veterans Affairs to draft applications for

and to maintain NRC licenses for the sites of the VA Palo Alto Health Care System (VAPAHCS). This is done as part of an agreement under a fixed cost reimbursement contract with the VA. A similar agreement covers services at Stanford University Hospital and Lucile Packard Children's Hospital, though the activities at the latter are encompassed by the University's license.

Regulatory Affairs

(Regulatory Drivers: 10 CFR 20 & 35, 17 CFR Licenses)

Health Physics advises the senior management on issues related to regulations that control the use of sources of radiation, both machines and radioactive materials. Health Physics maintains up-to-date regulations in a reference library. Health Physics also works in conjunction with the University governmental and community relations' staff to respond to proposed changes in regulations and laws relating to radiological safety matters that affect the University. The regulations governing use of radioactive materials are detailed and specific. Many of the regulations cross agency lines and regional jurisdictions. Health Physics is responsible for management of issues and resources related to regulatory controls of radiation.

Health Physics also coordinates compliance inspection activities when agencies conduct inspections. Under departmental policy health physics staff accompany inspectors. Health Physics investigates issues raised by inspectors, develops and implements corrective actions, and prepares formal responses to correspondence (including citations) from the inspectors.

Authorizations and Audits

The use of any source of ionizing radiation, either machine or radioactive material, must be reviewed in accordance with procedures established by the Administrative Panel on Radiological Safety (APRS). Health Physics receives initial applications from Principal Investigators (P.I.). The application is assigned to a professional level staff member who reviews the application, and makes a site visit, and meets with the P.I. or designated laboratory staff members. The health physicist then prepares a written hazards evaluation, enumerating hazards, safety considerations, and procedural requirements. The review may include design of shielding and specification of warning systems and access controls.

Hazard Evaluation and Control

The Radiation Safety Officer (RSO) reviews and signs the hazards evaluation, which becomes the official authorization to possess and use the sources. The P.I. and the project staff then sign, acknowledging the content of the hazards evaluation and accepting the conditions for use. Finally, the APRS or Local Control Committee (LCC) reviews the application and hazards evaluation and approves (or rejects) the proposed use. This approval may be done at a formal meeting or by simultaneously circulating the documents to the members. (Any member reviewing a circulated document may request a formal meeting of the committee.)

Initial renewals of authorizations and all renewals of human use authorizations are reviewed and processed within 15 months periods. Subsequent renewals on non-human research projects may be done biennially (within 25 months). The review process involves reviewing Health Physics monitoring/surveillance reports (see below), records of receipts, dosimetry and



STANFORD UNIVERSITY

bioassay reports, calibration records, reports of incidents (spills, losses, overexposure), waste disposal information, training records, inventories, leak tests of sealed sources--in short, all records of transactions related to the project.

Audits

During the renewal process a health physicist visits the site and audits safety including accountability, local surveillance (monitoring) records, on-the-job training and use protocols. Both of the above processes utilize a standard checklist that was developed by Health Physics to guide the process. The health physicist inspects the labs and protective equipment and discusses findings with the P.I. and representative(s). At this time the health physicist receives from the project any updated information or requests for changes. The health physicist advises the project of changes in policies or regulations, or of improvements that should be made in the P.I.s safety program. The health physicist also asks the P.I. and project staff for feedback on the on Health Physics programs. The audits are documented on a new hazards evaluations form that is reviewed and approved by the RSO. These hazards evaluations include a form for citing any safety or compliance issues that were found. That form serves as draft minutes for a safety meeting and constitutes a record of the required periodic staff retraining, which is done by the project. The project meeting does not

require the presence of a health physicist. After the project meeting the APRS or LCC reviews and approves (or disapproves) the renewal of the project.

Projects that have several areas of deficiencies, or repeated deficiencies may be granted short-term renewals of 30, 60, or 90 days followed by a confirmatory audit that cited deficiencies have been corrected. A second consecutive repeated deficiency may require that the P.I. meet with the Committee to develop a corrective action plan, which will be subject to confirmatory audit.

Compliance Reviews

The distribution of the various documents to the projects and to the committees is done mostly by FAX, with the exception that projects involving uses in humans must be reviewed at a sit-down meeting of the Clinical Radiation Safety Committee (CRSCo). The review process is tracked by an Administrative Associate, who maintains logs of the transactions, follows-up on late returns, refers questions to the assigned health physicist, and maintains the document files.

The license specifies the procedures described above. Deviations from procedures that are specified in the license could result in program deficiency findings (e.g., violations) by inspectors from the regulatory agencies.

Projects involving the use of radiation producing machines undergo annual surveys and reviews of compliance. In the hospitals and clinics this work is performed for and under agreements with the medical centers. The audits/radiation surveys of the machines are distributed to the P.I. or responsible clinician for information.

Deficiencies in clinical machines are reported to the Hospital Clinical Engineering Department for correction, then rechecked by Health Physics. Committees are involved in reviews and approvals of new and problematic machines. The machine authorization and review process is not required by licenses, which only address radioactive materials, but was established by the APRS to ensure that all radiological hazards were systematically monitored and controlled. NOTE: Operational parameters related to medical machines must be inspected annually, or at stipulated frequencies, as mandated by regulations and by the Joint Commission on the Accreditation of Healthcare Organizations). Reviews of projects are assigned to the professional staff on a regional basis; this allows the health physicists to become very familiar with a facility, the kinds of activities in the area and the personnel who are working in the area.

Administrative Panel / Committee Support

Purpose	Support major campus research committees
Program Elements	Administrative Panel on Radiological Safety Clinical Radiation Safety Committee Radioactive Drug Research Committee Non-Human Use Radiation Safety Committee Laser Safety Committee Administrative Panel on Human Subjects
Business Drivers	<ul style="list-style-type: none"> • Radioactive materials research • Human subjects • Clinical drug research

Background

(Regulatory Drivers: 17 CCR 30196, 10 CFR35 & 70, 21 CFR 312)

Health Physics provides staff support for the Administrative Panel on Radiological Safety (APRS) and its' subcommittees, the Clinical Radiation Safety Committee (CRSCo), the Non-Human Use Radiation Safety Committee (NHRSCo), the Radioactive Drug Research Committee

(RDRC) and the Laser Safety Committee. Health Physics maintains liaison with the Panel on Human Subjects in Medical Research (of which the RSO is an ex officio member), the Panel on the Care of Laboratory Animals, the Panel on Biosafety, the Environment of Care Committee at the Stanford Hospital, the VAPAHCS Research Safety Committee, the VAPAHCS Environmental Care

Committee, and the University Committee on Health and Safety.

Administrative Panel on Radiological Safety

Under the broad scope radioactive materials licenses issued by the State and NRC, responsibilities for approval, possession and use of radioactive materials



is delegated to radiation safety committees. The APRS meets two times annually. CRSCo and the RDRC (under FDA regulations), meet quarterly. The other committees meet at least semi-annually as required. The committee staff support includes scheduling of meetings, preparation of reports and materials in support of the committee, preparing and distributing minutes, advising on policies, advising the Dean of Research on prospective members, and preparing Radiation Safety Manuals. It also is responsible for disseminating and executing the policies that have been promulgated by the various committees. The VAPAHCS activities are under the oversight of the APRS and its' subcommittees and the University Radiation Safety Manual covers activities at all of the affiliated institutions, including the VAPAHCS. The use of joint committees by the VAPAHCS and Stanford reflects the fact that most of the senior clinical staff and researchers at the VAPAHCS are also Stanford faculty members. The subcommittees have responsibilities at both institutions; there is considerable movement of researchers between the two institutions; and the presence of members from both institutions provides a broader perspective in the evaluation of safety.

Clinical Radiation Safety Committee

CRSCo oversees all clinical uses of both radioactive material and radiation producing machines at both Stanford Hospitals and all their associated clinics and at the VAPAHCS. CRSCo reviews and approves authorizations, occupational radiation exposure reports, machine surveys and issues etc. CRSCo physicians that are authorized to treat patients with radioactive materials review and approve human research protocols for the APRS.

Radioactive Drug Research Committee (RDRC)

The RDRC is a FDA mandated committee that approves basic research involving newly formulated radioactive drugs. This committee's membership must be approved by the FDA. The RDRC meets quarterly to review open/active protocols. Additionally, annual reports must be submitted to the FDA containing summarizing information on active and inactive approvals, results and adverse effects.

Non-Human Use Radiation Safety Committee (NHRSCo)

The NHRSCo oversees all uses of radioactive materials and radiation producing machines not involving clinical and human subject research. NHRSCo reviews and approves authorizations,

occupational radiation exposure reports, machine surveys and issues etc. NHRSCo approves new authorized users, training requirements and locations.

Laser Safety Committee

The Laser Safety Committee oversees the use of Class IIIb and IV lasers in research. The Committee reviews and approves authorizations, training, user surveillance, installations, surveys and use issues etc.

Administrative Panel on Human Subjects

The RSO is an ex officio member of seven Administrative Panels on Human Subjects in Medical Research (APHSMR) and maintains liaison with them on medical research that involves radiation exposure to the participants.

Health Physics calculates estimated effective radiation doses for the research subjects for these research protocols when the radiation exposure is not part of standard clinical care. Health Physics can approve exposures below 5000 millirem. Above 5000 millirem, Health Physics forwards the protocol to the Clinical Radiation Safety Committee (CRSCo) for their consideration and approval. Using the guidance approved by CRSCo, Health Physics advises the APHSMR on the recommended "informed consent" language.

Database and Inventory Management

Purpose	Monitor records , inspections, schedules, training, bioassays, and reports; Track receipt, transfers, and disposal of radioactive materials
Program Elements	Relational databases Usage inventory management
Business Drivers	<ul style="list-style-type: none"> • Health Physics Operations • Radioactive Waste • Radioactive materials use

Database Management

(Regulatory Driver: 10 CFR 20)

Health Physics maintains vast information databases. The principal relational database was written by a consultant to cover many of the Health Physics Operations. It also generates most of the required records, controls the inspection of radioisotope

packages, schedules sealed source leak-tests and surveys, tracks training and bioassays, and generates review documents with data integrated into the text. Each Health Physics staff member and the Radioactive Waste Staff have a personal computer, which has access to a centralized data server. In addition there are numerous other computer programs,

which facilitate Health Physics operations. Data can be accessed remotely in emergency situations. Currently a new version of the software is being developed. The new program will be web based allowing easier remote access. This will also allow future improvements to let individual researchers to access to update inventories, survey results, persons, rooms,



etc as necessary reducing paperwork and improving efficiency.

Inventory Management

(Regulatory Driver: 17CCR30210, Licenses)

Conditions of the radioactive material license require that each project submit a quarterly verification of room usage, instruments, personnel and an inventory of materials on hand showing receipts, transfers, and disposals of materials. Health Physics provides special tutoring and assistance to those project personnel who are charged with the responsibilities

for completing the quarterly program review and inventory forms.

Quarterly Program Review

Health Physics sends a computer-generated list of users, survey instruments, use locations, etc. The project completes the forms recording changes, providing information about revised usage, new personnel and status of survey instruments. This data is then sent to Health Physics where we update our database and investigate any items of inconsistency.

Inventory Verification

Health Physics also sends a computer-generated list of all materials that were received during the previous calendar quarter, plus all materials that were previously on hand, to each project. The project, using its local records of use (forms provided by Health Physics with each shipment), provides information on disposals, transfers, and the current balances. This data is then sent to Health Physics where we check the balances against the authorizations, check sewer disposal against the allowable limits, and update the balances in the Health Physics database.

Exposure Monitoring

Purpose	Maintain exposure to radiation under allowable regulatory limits
Program Elements	Dosimetry Bioassays Thyroid Monitoring
Business Drivers	<ul style="list-style-type: none"> • Radioactive materials use • Radioiodine use • Radioactive spills or releases

Dosimetry

(Regulatory Driver: 10 CFR 20; Licenses, Univ. Policies)

State and federal regulations and the licenses issued by regulatory agencies require monitoring of personnel exposures and prescribe an extensive record maintenance system. Health Physics coordinates acquisition and assignment of approximately 2500 whole body badges and extremity dosimeters furnished monthly by accredited suppliers.

Health Physics maintains required records of exposure, furnishes exposure information to present and former employees, and requests previous exposure histories on behalf of new Stanford and VAPAHCS employees who use radioactive materials and are exposed to radiation sources. Health Physicists review all results and investigate lost dosimeters and exposures over thresholds established by APRS. Health Physics also exposes samples of dosimeters to known levels of radiation to maintain a check on the accuracy of the commercial services.

Exposures over regulatory limits must be reported in writing to the licensing agencies and to the person exposed. Such

reports usually involve detailed investigations of the circumstances of the exposure. Expunging spurious exposures from records also requires review by licensing agencies. Such changes require careful investigation and written justification by Health Physics.

Health Physics evaluates various commercial services and advises clients and Procurement Services on the suitability of services. Vendors also supply a number of services to enhance the effectiveness of the program and to improve the compliance of the program. Health Physics reviews vendor submittals and helps to facilitate contracts with those that are suitable.

Thyroid Monitoring and Bioassay Program

(Regulatory Driver: 10CFR 20, 35)

Radioactive material licenses require that personnel who perform labeling experiments using radioiodine or who use specified, large quantities of other volatile radioactive materials have assays to evaluate the deposition of radioactive materials in their bodies. The thyroid assay program performs counts on all persons identified by projects as having

performed labeling procedures in the previous quarter.

The thyroid counter, located at Health Physics, is periodically calibrated against National Institute for Standards and Technology (NIST) prepared standards and standards of a peer intercomparison program. The counter is routinely checked as part of the laboratory quality assurance program. Records of iodine users are maintained in the database and the written results of assays are maintained in project files (at ESF) and are sent to the PI.

Other bioassays, such as urine monitoring, are performed as circumstances arise; either triggered upon receipt of larger activity levels at the inspection station or after spills or releases. Calibration of instruments used for these samples is done using suitable reference standards. Reporting and recording is similar to the thyroid assay program. Professionals and clerical staff are involved in the identification of and follow-up on persons who require such assays. Counting systems must be maintained and calibrated routinely with samples traceable to NIST to maintain the capability of performing such analyses when needed. Dosimetry is calculated in accord with regulatory



instructions. Records must be maintained of all such tests and dosimetry.

Contamination Surveys / Tests and Response

Purpose	Limit discharge of radioactive materials into the environment Survey laboratories for contamination Respond to spills and incidents involving radioactivity and radiation exposure Calibrate instruments used for radiation detection.
Program Elements	Environmental monitoring Laboratory surveys and oversight Sealed source leak tests Emergency Response Instrument Calibration
Business Drivers	<ul style="list-style-type: none"> • Environmental and laboratory releases • Spills involving radiation • Sealed source use

Environmental Monitoring

(Regulatory Driver: 10CFR20:1302)

Health Physics analyzes samples of sewer effluents from various laboratory buildings to determine the concentrations of radioactive materials in the effluents. (The sampling is done to confirm compliance with sewer plant requirements related to chemical waste disposal). Contractors working under the Utilities Department collect the samples and submit them to Health Physics. Regulations and licenses limit both the concentrations and total levels of radioactive materials that can be discharged. The measurements verify the estimates of disposal that are inferred from the submittals in the inventory program. Results of such tests are furnished to the sewer plant management periodically. Also, when needed, Health Physics may sample and analyze air from labs to assess releases during handling of volatile radioactive materials. Radiation measurements are made around the radioactive waste storage facility and around major accelerators, and in clinical areas and around other sources of radiation to evaluate the effectiveness of shielding. Particularly doses are measured in visitor or public areas adjacent to X-ray machine installations and nuclear medicine. Assessments of releases of airborne radioactivity are made and documented under the requirements set forth in the "National Emission Standards for Radionuclide Emissions from Facilities Licensed by the Nuclear Regulatory Commission..." (40 CFR 61 and in 10 CFR 30). This compliance is audited and enforced by the Department of Public Health (DPH) / Radiological Health Branch (RHB), and at the VAPAHCS by the Nuclear Regulatory Commission

(NRC). Releases are separately assessed for the University, the Cyclotron, the local Stanford Health Care facilities, and for the VAPAHCS. Radiation measurements are conducted by passive and active monitors around the radioactive waste storage facility, the cyclotron facility, in clinical areas and around other sources of radiation to evaluate the effectiveness of shielding. These measurement results are evaluated to ensure that members of the public are not exposed to levels above the regulatory limits.

Laboratory Surveys and Oversight

(Regulatory Drivers: 17CCR30275; 10CFR20)

Regulations and the license require that Health Physics staff perform periodic radiation surveys and inspections of areas where radiation sources are used. DPH, JCAHO, and the VA Radiology Manuals require inspecting of medical machines for a variety of safety items and stipulate the frequency. DPH Regulations also require surveys for non-medical radiation sources. For all radiation-producing machines, measurements and inspections are done at the time of installation and thereafter annually, biennially, or after changes in major components. Interlock and warning systems at large research accelerators are checked by Health Physics prior to operation and the machines are monitored during and after operation. For labs where radioisotopes are used, the licenses mandate the scope and frequency of radiation surveys to be performed by the users and by Health Physics. As noted above, Health Physics periodically audits each project's compliance in performing its local surveys. Health Physics program survey frequencies vary from biweekly,

bimonthly, quarterly, three times annually, to annually for each project, based on the hazard level of the authorized use. Scheduling is done utilizing computers; results of surveys are also maintained in the computer archives. An Administrative Associate maintains computerized drawings, prints out survey forms, updates records, and files hardcopies of the surveys. Routine surveys in University labs are performed by the members of the EH&S Compliance Assistance Program (CAP). Health Physics staff performs surveys at the medical centers and VAPAHCS. The surveys include measurements of radiation and contamination levels in and around the labs and also inspections for proper posting and labeling. A few other compliance items are checked including the following: performance of required user surveys (checked each month), exclusion of food and drink from radioactive materials work areas, and waste related items. Hazardous conditions and compliance issues are noted and reported to the laboratory occupants. Examples of possible action items include: excessive radiation levels, indicating lack of shielding; contamination exceeding limits specified in the Manual; food or drink in radioactive work areas; lack of proper security of radioactive materials; radioactivity in general trash; failure to perform user surveys at required frequencies; and improper posting or labeling. Health physicists are responsible for follow up on major and repeat problems to assure timely correction. Enforcement action policies are defined by the APRS. These range from "warnings" to formal "notices" to the P.I., requiring written response to the APRS or LCC. Subsequent steps include requiring committee hearings with the P.I., or, if the problems remain uncorrected suspension



or termination of a project. The latter actions require committee actions and are subject to appeal procedures. All surveys and inspections are documented and filed. Both the results (encoded) and updated room drawings are included in computer data bases to expedite production of new survey forms, summarize previous inspection histories for surveyors, and to facilitate the annual project audits. Health Physics staff provides instruments, standardized procedures and training for CAP staff. Periodically a health physicist accompanies the CAP team members during surveys to ensure uniformity and quality in the program.

Sealed Source Leak Tests

(Regulatory Driver: 17CCR30275; Licenses)

Regulations require the testing for leakage at defined intervals, quarterly or semiannually those radioactive sources that are in sealed forms (metal or plastic capsules) to prevent leakage of radioactive material. A Health Physicist staff member goes to the laboratory, takes smears of the surface of the source or mechanism housing the source, and counts the sample in a calibrated radiation analysis system for the presence of radioactive leakage. Also,

during the visit radiation surveys are made of the areas where the materials are stored or used. Sources found to be leaking are withdrawn from use and reported to the State. Presently there are approximately 100 sources that require testing and about 500 total sources in the accountability records. A second professional reviews the test results, and a report is sent to PIs to inform them of the results. Central records of the tests are maintained by Health Physics.

Emergency Response

(Regulatory Drivers: JCAHO; Univ. Policies)

Health Physics maintains a twenty-four hour emergency response capability for spills and incidents involving radioactivity and radiation exposure. Responses frequently arise related to management of patients in the Hospitals; there are also infrequent spills, losses, and releases of materials. Spill kits and survey instruments are stocked, staged and ready for use. Health Physics also develops, and advises the hospitals in preparation of, contingency plans for admitting radioactive contaminated (or radiation injured) patients. Emergency supplies for decontamination of patients are

maintained. Drills may be conducted to evaluate the plans. Health Physics is responsible to notify regulatory agencies of specified incidents. Health Physics maintains files of reports and follow-up actions.

Instrument Calibration

(Regulatory Driver: 10 CFR 20,35, Licenses)

All meters used to measure radiation exposure levels or contamination must be calibrated at least annually. Health Physics picks-up, calibrates and returns approximately 500 meters to labs, annually. The meters are calibrated against NIST traceable sources in the calibration range at the ESF using a variety of sources to ensure that the instruments read correctly. Instruments are calibrated at two points on each range to within 20% of correct readings and must have correction charts or graphs affixed if the errors exceed $\pm 10\%$. Users are informed about the limitations of the instruments and of instruments that are not performing properly. A computer database is maintained of all instruments that require calibration. Results of calibrations are documented, furnished to projects, and hard copies are filed.

Facility Plan Reviews and Decommissioning

Purpose	Ensure facilities meet radiation safety regulations; Maintain central records of all facilities using radioactive materials; Survey and remove radioactive residues ; Prevent exposure of service personnel.
Program Elements	Plan Reviews Decommissioning (Tracking of radioactive materials, spills and contamination, and construction plans; Hazard Assessments; Reports to regulatory agencies)
Business Drivers	<ul style="list-style-type: none"> • New Construction and Remodeling (renovations) • Facility Usage changes • Laboratory moves

Plan Reviews

(Regulatory Driver: Univ.Policies, 22 CCR, Licenses)

Health Physics reviews all plans for new or renovated laboratory buildings and clinical facilities, where radiation sources will be housed and/or used. Shielding, ventilation, access controls (security), floor and bench-top coverings, safety equipment and other features are evaluated and recommendations made to the appropriate department at the University, the Hospitals, and / or the VAPAHCS. New facilities are inspected prior to activation to ensure that

the facilities meet appropriate radiation safety regulations. For Hospital installations at both of Stanford's Hospitals, Health Physics prepares the required reports for review and approval by the State of California Office of Statewide Health Planning and Development (OSHPD). Health Physics maintains required central records of all facilities that are used for radioactive materials, including records of what radioisotopes are used and spills that have occurred. On a quarterly basis projects submit a written response indicating what

facilities are used, what radioisotopes are used in the facilities, and whether there have been any spills. This is included in the inventory process. In addition maps of all laboratories where isotopes are used are prepared and maintained in Health Physics files; the maps are updated by information generated during Health Physics reviews and surveys. The maps are part of the documents used in the Compliance Assistance Program surveys.

Decommissioning



(Regulatory Driver: 10 CFR 20, 17 CCR 30256, Licenses)

When a facility where radioactive materials have been used or high-energy accelerator machines have been housed is to be shut down and the area released for unrestricted use (including remodeling or demolition), regulations require that the facility be decommissioned. The process requires active tracking of the usage of materials in all facilities, records of spills and contamination, and maintenance of complete construction plans of the facilities (the last is done by others). When the facility usage is to change, Health Physics makes an assessment of the scope of tests and measurements that will be required. Then, if required by the regulations, a formal decommissioning

plan will be prepared and submitted to the regulatory agency. The plan is then implemented, comprehensive surveys are performed, radioactive residues are removed for proper disposal, and a report is prepared for the regulatory agency. Many times the decommissioning projects are large scale and require employment of contractors to perform the surveys and removal of contaminated (or activated) items. Health Physics manages such projects and is responsible for preparation and submission of reports to the regulatory agencies. Health Physics must also ensure that required financial assurances are submitted to the regulatory agencies as required. These reports are prepared by Risk Management and signed by the Chief Financial Officer.

Decommissioning is a highly regulated activity. Guidance procedures are stipulated in manuals that are prepared by the regulatory agencies. Health Physics and the Compliance Assistance Program also conduct comprehensive surveys in any radioisotope lab that is to be released to other projects even when the subsequent occupants may use radioactive sources. Also, all laboratory equipment (freezers, bio-hoods, incubators, plumbing, etc.), which is used for radioactive research is checked prior to release to uncontrolled areas or which will be serviced by repair persons. These steps are designed to ensure that the persons (public or employees) are not exposed to radiation or contamination.

Radioisotope Production

Purpose	Support increased production of radioisotopes; Prevent over exposure to personnel and public; Avoid increased license fees and scrutiny.
Program Elements	Clinical Isotope Production Research Isotope Production
Business Drivers	<ul style="list-style-type: none"> Commercial distribution of radioisotopes Molecular Imaging Radiochemistry facility use

Molecular Imaging Program at Stanford Cyclotron and Radiochemistry Facility (Regulatory Drivers: 10 CFR 20; Licenses, Univ. Policies)

Molecular Imaging Program (Clark Building) and the associated Cyclotron and Radiochemistry facilities (Lucas Expansion Building) have brought a many orders of magnitude increase in the level of radioactivity produced and used on campus. The cyclotron and radiochemistry facility produce positron emitting (PE) isotopes that are formulated to allow imaging in humans, animals and at the molecular level. The cyclotron production includes F18, C11, N13 and potentially Cu 64. The radiochemistry facility uses the various isotopes and other PE isotopes delivered from outside facilities to produce various imaging drugs.

The facilities house an animal PET scanner, shielded animal injection tables, radiopharmaceutical hot cell (heavily shielded allowing remote manipulation)

preparation areas for both research and clinical production and a 18 MV cyclotron inside a shielded vault to produce the required isotopes. The cyclotron / radiochemistry facility requires a significant effort from health physics. Complex issues resulting from this installation include significantly increased personnel exposures, shielding design and verification, ventilation, dose to the public surveillance, effluent monitoring and isotope delivery. The regulations are outlined in or license, Title 17 and 10 CFR 20.

Clinical Isotope Production

Currently the facility is providing daily production of FDG F18, the most commonly used clinical PE drug, to both of the existing PET scanners in Nuclear Medicine and Radiation Oncology. Additionally, we are preparing an

application to the RHB to allow potential commercial distribution of clinical and research isotopes off campus to non-Stanford clinical facilities. This will continue to increase the complexity and support required for this operation and will also lead to increased license fees and scrutiny from outside auditing agencies.

Research Isotope Production

The cyclotron facility is providing daily production of various forms of F18, C11 and N13 for imaging research in Humans, animals and cells. Production is expected to continue to increase as new compounds and imaging methods are developed using PE isotopes. This continues to increase the complexity and support required for this operation and will also lead to increased license fees and scrutiny from outside auditing agencies.

Human Subjects and Clinical Patients



Purpose	Prevent overexposure to patients and medical staff; Facilitate use of investigational new drugs; Ensure Patient Consent
Program Elements	Human Clinical Use Human Research use
Business Drivers	<ul style="list-style-type: none"> • Radioactive materials and Radiation producing machine use • Medical centers • FDA regulations

Clinical Use

(Regulatory Drivers: 17 CCR 30195, 10 CFR 35, 21 CFR 361)

Uses of radioactive materials or machine produced radiations involving clinical patients, is on the increase in the medical centers. The licenses and regulations include many special procedures that must be followed by clinical projects. Health Physics staff provides special support in the clinical areas by assisting physicians in evaluating radiation doses to patients and by ensuring all proper regulations regarding documentation, administration, dose calibration, patient release, isotope inventory and many other legal requirements are followed. Also, Health Physics provides more extensive survey support, in-service training for nurses, residents, fellows and attending physicians, prepares a special written radiation safety guidance for hospital staff, performs the required annual quality control testing on all clinical x-ray devices and prepares and clears patient rooms where radioactive patients are housed. Most room clearances in the clinical areas are done by the Radioactive Waste staff. Health Physics performs shielding analysis and shielding

approval surveys for the x-ray installations throughout the medical centers including PET/CT, CT, Linear Accelerators, and Fluoroscopic rooms in Radiology, Cardiac Cathology, Radiation Oncology and Nuclear Medicine.

Research Use

(Regulatory Drivers: 17 CCR 30195, 10 CFR 35, 21 CFR 361)

Uses of radioactive materials or machine produced radiations involving human subjects, is subject to much more stringent controls than most other uses. The licenses include a number of special procedures that must be followed by clinical projects. FDA regulations also apply to research uses involving human subjects. Health Physics staff provides special support in the clinical areas by assisting physicians in evaluating radiation doses to patients and by assessing the risks associated with such doses. Also, Health Physics provides more extensive survey support, in-service training for nurses, prepares a special written radiation safety guidance for hospital staff, and prepares and clears patient rooms where radioactive patients are housed. Health Physics also obtains,

collates and submits required reports to the FDA for research projects that involve administration of radioactivity to patients. Health Physics also assists P.I.s in preparing applications to the FDA for projects that involve Physician Sponsored Investigational New Drugs (radioactive drugs).

Proposals for medical investigations that involve radiation exposure of human subjects, either normal clinical procedures or procedures specifically related to the research, are also reviewed by the CRSCo. Health Physics assists the applicants in assessing the doses and ensuring the Patient Consent Forms describe risks in terms that the CRSCo has approved. In these reviews the data that Health Physics has collected in the routine compliance testing of the machines are utilized to evaluate the doses to the subjects. Procedures that involve exposures above certain trigger levels specifically related to the research are referred to the CRSCo for review. Applications are referred to CRSCo (Health Physics) through the Administrative Panel for the Use of Human Subjects in Medical Research.

Radioactive Materials Delivery

Purpose	Monitor radiation levels of packages Check packages against authorization limits Inspect shipments for transport (against Department of Transportation regulations)
Program Elements	Deliveries of radioactive materials Shipment of dangerous goods
Business Drivers	<ul style="list-style-type: none"> • Radioactive materials use • Veterans Affairs projects • Radioactive materials shipments

Deliveries

(Regulatory Drivers: 10 CFR 20:1906; 49 CFR 173, Licenses)

All radioactive materials shipments (except the daily diagnostic shipments for Nuclear Medicine use) are received at the Health

Physics inspection room located at the hospital receiving dock. All packages are monitored for radiation levels and surface contamination and the receipts are checked against authorization limits. The receipts are entered into a database, which serves as

the basis for accountability, which must be maintained by each project. About 10% of the receipts are for VA projects. Most of the VA materials are purchased under grants funded through the University. Once inspected, packages are picked up and they



are taken to an intermediate staging area where they are picked-up by users, or they are delivered to the using projects by a contractor courier group or by Health Physics staff. Health Physics staff delivers packages destined for the VA. In April 1998 the elimination of the University Stores Department led to Health Physics having to contract for delivery of packages. At the Medical Center the delivery is now done by hospital contractor which provides linen and delivery services. Biology Stores

picks-up and stages packages at its facilities for pick-up by users.

Shipments

The complexity of transport regulations (involving several agencies) and the conditions of licenses require that Health Physics inspect and certify all outgoing shipments of radioactive materials. While there are relatively few such shipments, Health Physics employees must undergo appropriate training in Department of

Transport (DOT) regulations and be able to certify such shipments. The inspection of the incoming and most outgoing packages is done at the Health Physics radioactive package inspection station located at the Medical Center. Health Physics also contacts prospective recipients and ensures that the University obtains and retains copies of licenses as required by the regulations. Health Physics maintains files of the DOT certifications of packages and records of radiation measurements and shipping documents.

Training

Purpose	Develop training materials; Promulgate the recognition of hazards, risks, and control measures; Facilitate training sessions and seminars
Program Elements	Training materials Classroom Courses Sessions and Seminars Online courses
Business Drivers	<ul style="list-style-type: none"> • Personnel exposure (potential) • New users • Radiation producing machine use

Training

(Regulatory Drivers: 17 CCR 30255; 10 CFR 19; 8 CCR 3203)

Federal and state regulations mandate that all persons exposed to radiation receive appropriate training to recognize hazards and risks and understand how to control exposures. The licenses spell out training requirements. These range from eight-hour formal courses and/or testing, to in-services, orientations, and training of supervisors. Each of these efforts also requires the preparation of training materials. Also, Health Physicists participate as lecturers in academic courses and seminars. The ongoing training efforts are a major program that involves the professional staff and the clerical staff to identify, train and document the training of

persons who use radioactive materials or frequent areas where exposure can occur.

Specific Training Efforts include a *Basic Course* (8 hours duration) in radiation protection for users of unsealed radioisotopes (persons without prior training or experience). There is also *training by examination* for users of 1) Unsealed Radioisotopes (intended for persons with prior training and/or experience), and Sealed radioisotope sources and for users of self-shielded irradiators. The office also conducts *Radiation Safety Orientations* for the VA and *Employee Orientations* for the hospital. *In-service training* is provided for nurses who care for patients containing therapeutic levels of radioactive materials.

Training sessions and seminars are provided for residents, fellows, and radiological technicians who work with medical X-ray machines. Seminars are given in Radiology, Nuclear Medicine and Radiation Oncology Physics and Radiobiology courses. Orientation is given to all new Nuclear Medicine Residents, both long-term and rotating. In-services are given in various departments to facilitate safety and compliance efforts. Training is provided for users of X-ray diffraction machine operators (this uses a text and videotape). Additionally,

Laser training is provided mostly online and in person upon request by departments. Records for such training are maintained by projects and Health Physics.

Laser Safety and Non-Ionizing Radiation

Purpose	Prevent injury resulting from use of lasers and non-ionizing radiation; Follow ANSI regulations.
Program Elements	Laser Safety Non-Ionizing Radiation
Business Drivers	<ul style="list-style-type: none"> • Laser Use • Ultraviolet, Infrared, and Electromagnetic radiation use • ANSI Standards

Laser Safety



STANFORD UNIVERSITY

(Regulatory Driver: Univ. Policy; 8 CCR 3203)

Health Physics advises the University on laser safety issues and works with the Laser Safety Sub-committee (LSS) of the APRS to review and develop laser safety policies and procedures. Laser safety regulations in California are minimal. Cal/OSHA usually responds to reported incidents by issuing special orders to an offender. The special orders usually mandate that the employers adopt standards prepared by the American National Standards Institute (ANSI). (The ANSI standards are developed by consensus of a committee of experts from industry and government.) Health Physics

also works with other divisions of EH&S on issues related to lasers. The University Laser Safety Manual (2006) incorporates many ANSI recommendations. The Manual is presently being up-dated and the program reviewed by the Laser Safety Committee (a subcommittee of the Administrative Panel on Radiological Safety). Health Physics performs an inventory of high-powered lasers, maintains training materials for use by projects, provides printed signs, performs inspections of facilities, and advises projects on laser safety issues. The laser safety effort is a limited one when compared to the ionizing radiation safety program. Projects use a self-inspection

form, developed by Health Physics, to review workplaces for hazards.

Non-Ionizing Radiation (others)

Health Physics responds to requests for guidance on safety related to ultraviolet radiation, radio-frequency radiation, extremely low frequency electromagnetic radiation and microwave radiation. We maintain a limited capability to measure such radiations, and we also provide some information, assistance and guidance, using ANSI standards and other publications as references.



Code Compliance and
Development
Inspections
Liaison
Fire Protection Systems
Fire Alarms
Fire Investigations
Plan Reviews
Training

Fire Safety



The primary goals of the University Fire Marshal's Office are to: 1) Support Stanford's core mission of teaching, learning and research by effecting institutional compliance with the fire codes and regulations, 2) Work strategically with the external agencies to achieve equitable interpretation and application of codes to minimize undue constraints on the operational efficiency, and 3) Ensure that a high level of fire protection is afforded to the Stanford community.

Supports these University Units:	Technical Services Provided	Business Drivers
<ul style="list-style-type: none"> Stanford Main Campus School of Medicine Hopkins Marine Station SLAC National Accelerator Laboratory New construction and remodeling 	<ul style="list-style-type: none"> Code Compliance Plan Reviews Inspections Liaison with local jurisdictions Maintenance and Testing Remote Fire and Intrusion Alarm Monitoring Station Training Fire Investigations Special Event Planning 	<ul style="list-style-type: none"> Fire Prevention Engineering Building and Fire Codes Hazardous Materials use Annual fire safety inspections Cost of risk Multiple jurisdictions Fire-fighting service contracts Equipment failures and After-Hours response Building occupancy



University Units Supported

The University Fire Marshal’s Office serves the main campus, the School of Medicine and the Hopkins Marine Station. The Fire Extinguisher Technicians provide fire extinguisher services for the University and SLAC National Accelerator Laboratory.

Program Elements

Overview

Code Compliance	Plan Reviews New Construction and Renovation	Inspections	Liaison Local Jurisdictions	Maintenance and Testing
<ol style="list-style-type: none"> Code interpretation and Analysis Plans Review Alternative Design Proposals Field Inspections 	<ol style="list-style-type: none"> Architectural Drawings Automatic Fire Sprinkler Drawings Fire Alarm Drawing TGO Systems Access Control Systems Smoke Control Systems 	<ol style="list-style-type: none"> Fire Safety Self-Inspections Insurance Surveys Acceptance testing for fire alarms, fire sprinklers, toxic gas and smoke control systems 	<ol style="list-style-type: none"> Fire Department Access Code compliance issue resolution Joint inspections and Fire Protection System Acceptance Tests Fire-related Emergency Response investigations and reports 	<ol style="list-style-type: none"> Workorders and Test Sheets Troubleshooting, Repair, and Replacement Building Occupant Notifications Visual Inspections Equipment Calibration

Remote Fire and Intrusion Alarm Monitoring Station	Training	Fire Investigations	Special Event Planning	Code Development and FDCS
<ol style="list-style-type: none"> Wireless radio transceivers Servers Head-End Equipment Manitou System Building Alarm accounts System tests and resets Troubleshooting Alarm and Signal Traffic Palo Alto 911 Center 	<ol style="list-style-type: none"> New Student Safety training (Fire Safety) School and Department training Planning Workshops Graduate Housing and Undergraduate Housing Building evacuation drills 	<ol style="list-style-type: none"> Palo Alto Dispatch Center (PADC) Housing fire incidents Fire protection system functionality Emergency response issues 	<ol style="list-style-type: none"> Event Planning Student Parties 	<ol style="list-style-type: none"> Existing H-8 \ L (laboratory) occupancy requirements Santa Clara County-wide local amendments to the new California Fire Code.

Stanford University is subject to numerous codes and standards which regulate the design, construction and use of buildings with the intent of preventing fire and protecting life and property. The governing jurisdictions include Santa Clara County, Cities of Palo Alto, Menlo Park, Redwood City, Newark, and Pacific Grove, the County of San Mateo as well as Office of Statewide Health Planning and Development (OSHPD). The University Fire Marshal’s Office is presently staffed by 19.0 FTE employees, who serve the main campus, the School of Medicine and the Hopkins Marine Station. The Fire Extinguisher Technicians provide fire extinguisher services for the University and SLAC National Accelerator Laboratory.

Code Compliance

Background

Stanford University is subject to State regulations which include Title 19, the Public Safety Code and Title 24, the California Building Standards Code. Title 24 is further divided into 10 parts including Part 2, the California Building Code; Part

3, the California Electrical Code; Part 4, the California Mechanical Code; Part 7, the Elevator Safety Code; Part 8, the Historical Building Code and Part 9, the California Fire Code. The National Fire Codes, published by the National Fire Protection Association, consisting of 15 volumes and

over 280 standards are also adopted by reference in the State codes or used as authoritative guides in determining recognized fire-prevention engineering practices. Additionally, local jurisdictions such as Santa Clara County and City of



STANFORD UNIVERSITY

Palo Alto have adopted more stringent local codes & ordinances.

The Building and Fire Codes are extremely complex as they apply to hazardous occupancies such as laboratory buildings. While the codes are intended to safeguard life and property, the present codes are highly prescriptive in nature. A strict application of the letter of the code may at times unduly restrict the functions of a building with minimal gain in safety. University Fire Marshal staff provides consultation and oversight on a wide range of fire protection and life safety issues to ensure that applicable codes are followed and equitably applied to achieve safety and compliance, without restricting research and operations. Our clients include Department of Project Management (DPM), Buildings and Grounds Maintenance, Student Housing and Residential Dining Enterprise, Athletics Department, School of Medicine, Office of Risk Management, and many others.

Key Activities

The University Fire Marshal is a member of the Technical Team for DPM projects. University Fire Marshal staff provides code consultation in the delivery of capital projects throughout all phases of design and construction. Services include code interpretation, plans review, analyzing code issues, proposing design alternatives as appropriate to achieve compliance, and field inspections. Code issues are identified early in project design to reduce risk of project cost overruns and delays. Often times University Fire Marshal staff works collaboratively with other EH&S staff on inter-disciplinary issues.

Trends

Increasing client demands for shorter plans review turnaround time have and will continue to strain current resources of the University Fire Marshal's Office. More recently DPM expects one week turnaround for plans review whereas in the past it has been two to three weeks.

Risks and Mitigations

The University Fire Marshal's Office has been providing technical oversight in addressing various risks over the years. These risks if not mitigated may present adverse operational impact, health decrement as well as liability to the University. The following presents some examples of significant risks that have been addressed:

Fire Sprinkler Retrofit in Science Buildings. There were existing science buildings that were not protected by automatic fire sprinkler systems, therefore presenting a life safety and property loss risk. Two of the major buildings were Mitchell Earth Sciences and Varian Physics. Sprinkler systems have been installed in these buildings.

Fire Alarm System Upgrades. Fire alarm systems provide early warning to building occupants and facilitate timely fire department response in the event of fire or other emergencies. However, the functionality of these systems can be compromised due to age and unavailability of parts. Working in conjunction with Buildings and Grounds Maintenance and Student Housing, University Fire Marshal staff provided due diligence studies and technical support for Fire Alarm System upgrades.

Seismic Shutoff Valves on Natural Gas Lines. Seismic events present a significant risk to campus facilities. University Fire Marshal's Office, in collaboration with other campus departments, has worked towards installing shutoff valves on natural gas lines supplying buildings. Work is completed in Academic and Athletic buildings as well as Housing and Dining facilities.

Inert Cryogenic Dewers. Santa Clara County Fire Marshal's Office misinterpreted the Fire Code and required O₂ deficiency sensors to be monitored by a constantly staffed facility and system connected smoke detectors in laboratory buildings where storage and use of inert

cryogenics exceeded 20000 ft² which practically included all our lab buildings. The risk did not justify these safety measures and the cost and operational disruption would have been excessive. SUFMO personnel contacted multiple code authorities and convinced the County that their interpretation was incorrect. The issue is close to being resolved.

Elevator shunt trip. On elevator shunt trip, County Fire required delayed shunt trip when the heat detector was activated while the State Elevator Agency required immediate shunt trip. The two regulations contradicted with each other. However, the County Fire Marshal refused to resolve the conflict. SUFMO contacted California State Fire Marshal and finally arrived at a solution that was reflected in the January 2012 published Building code revisions.

Compliance Issues and Regulations

Fire and Building codes are extremely complex, especially as they apply to science and research facilities. University Fire Marshal staff engages in extensive discussions and negotiations with local jurisdictions on a regular basis to effect compliance and resolve code issues.

Future Needs / Challenges

The California Building Standards Commission has adopted the International Building and Fire Codes. These codes have become effective since January 1, 2008. Due to the different nature of these new codes, additional time and resources are required to maintain the high level of technical services needed to support our clients. The California Codes are on a three-year cycle. The 2010 CBC and CFC have become effective on January 1, 2011. It is important for University Fire Marshal staff to become familiar with the differences between the 2010 codes and the 2007 codes. Additionally, the new codes will drive additional needs in terms of software and hardware to more efficiently carry out the daily activities of the University Fire Marshal's Office.

Plan Reviews

University Fire Marshal's Office conducts plan review of new construction and renovation projects including related fire sprinkler and alarm systems for

compliance with applicable codes and standards. Review comments are forwarded to the Project Manager so that issues can be properly addressed and code

deficiencies mitigated prior to submitting the drawings to the local jurisdictions for the required permits. This accelerates the permit process and helps to avoid delays in



STANFORD UNIVERSITY

project completion and building occupancy.

The internal technical review has an acknowledged benefit to the institutional projects in terms of significant time and resource cost savings. Many of the cost savings and resolution of code and fire protection engineering issues would not have been possible without the active involvement of the University Fire Marshal's Office. SUFMO coordinates review for all technical groups within EH&S; comments are forwarded to the Project Manager and architect for incorporation into the drawings.

Architectural Drawings

The review of architectural drawings includes: occupancy classification and construction type, exterior wall and opening protection due to proximity to

property lines, building allowable floor area, building height and number of stories, engineering controls pertaining to the use and storage of hazardous materials, chemical inventory, emergency exits, interior wall and ceiling finish, emergency use of elevators, and fire department access and fire hydrant locations.

Automatic Fire Sprinkler Drawings

The review of Automatic Fire Sprinkler drawings includes: sprinkler coverage and spacing, piping support and earthquake bracing, type and temperature rating of sprinklers, valve locations, hydraulic calculations, fire department pumper connection, water supply, hose allowance, underground fire mains, and fire pumps and standpipes.

Fire Alarm Drawings

The review of Fire Alarm drawings includes: control panel and devices, power supplies, door holders, fan control, fire/smoke damper control, circuit and riser diagrams, type and size of wiring, wire color coding, battery and voltage drop calculations, sequence of operations matrix, and fire alarm zone schedules.

Other services

Other services provided by the University Fire Marshal's Office include: Perform LEL calculations to determine if fire sprinklers are required in fume hood exhaust ducts; Produce CBC hazardous materials summary report to determine appropriate occupancy classifications for laboratory projects; and Calculate fire flow available from fire hydrants using Stanford Water Department flow test data.

Inspections

New and Renovated Buildings and Fire Protection Systems

University Fire Marshal staff inspects building sites to address code related issues pertaining to fire department access, and proximity to adjacent buildings et al. Inspections of new construction and fire protection systems are conducted during different phases of construction to verify compliance with approved plans. Pre-testing of fire alarm systems are conducted prior to the final acceptance tests with the local jurisdictions. The location of EH&S on campus allows University Fire Marshal staff to respond promptly at the request of contractors and Project Managers to visit construction sites to address and resolve various problems.

Self-Inspections

Background

In the years prior to 1991 annual inspections of all existing buildings were conducted by the University Fire Marshal's Office. In 1991, the Santa Clara County Fire Marshal's Office entered into a contract with Stanford University to provide annual inspections for all existing buildings. Initially the County's inspections were limited to the facilities operated by the Housing and Dining Services Department. By 1994 those inspections were expanded to include the

various Assembly Occupancies on campus. In June of 1995 the contract was renewed. This contract expired at the end of 1998 and it has been renewed in June of 2011 with the County devoting 0.75 full-time Deputy Fire Marshal conducting inspections at Stanford. In April of 1999 Stanford submitted to the Santa Clara County Fire Marshal's Office a proposal to establish a Self-Inspection Program. That program would seek to work in concert with the County's Inspection Program to facilitate fire safety inspections for all buildings on campus. Under this proposal, the Santa Clara County Fire Marshal's Office would continue to inspect all occupancies regulated under the California Code of Regulations Title 19, while the University Fire Marshal's Office would conduct inspections for the remaining occupancies on campus. The proposal was accepted by Santa Clara County Fire Marshal's Office.

Key Activities

The University Fire Marshal's Office conducts annual and bi-annual inspections of approximately 250 buildings on campus. These inspections have been broken down into two groups, laboratory and non-laboratory buildings. **Laboratory buildings.** Laboratory Buildings include facilities that maintain a chemical inventory. Due to the special hazards

associated with storage and use of hazardous materials, these facilities are inspected on an annual basis. **Non-Laboratory Buildings.** Non-laboratory buildings are facilities such as office buildings, libraries and small retail establishments on campus. These types of facilities pose a lower risk to occupants with regards to fire and life safety and are inspected every other year.

Trends

Stanford University continues to experience rapid growth in construction of new buildings and additional facilities are planned for the coming years. The construction of new buildings will increase the number of regular inspections that will be conducted by the University Fire Marshal's Office.

Risks and Mitigations

Annual fire safety inspections enhance the level of safety to building occupants as it provides timely observation and mitigation of deficiencies. Currently the University Fire Marshal's Office staff inspects non-laboratory buildings every other year. Increasing the inspection frequency for these facilities is recommended to provide closer oversight to these facilities.

Compliance Issues and Regulations



STANFORD UNIVERSITY

The University Fire Marshal's Office has successfully achieved compliance with fire safety codes for a few buildings that required extra time due to budget constraints. This has been accomplished utilizing a compliance schedule whereas University Fire Marshal's Office enters into an agreement with a Building Manager to correct deficiencies within a timeframe acceptable to both parties.

Future Needs / Challenges

With the adoption of the new Codes in Jan. 2008, the University Fire Marshal's Office would need to upgrade the existing Inspection Database. The current database is a homegrown model that presents challenges to its users. A new user-friendly Inspection Database has been purchased with pre-programmed new Codes. This has enhanced the efficiency of the Self-inspection program. In order for the University Fire Marshal's Office to inspect 100% of the non-state mandated facilities annually, both laboratory and non-laboratory, it will be necessary to add an additional Fire Inspector position to our current staff.

Insurance Surveys

Background

Insurance surveys are conducted annually by representatives of XL Insurance, property insurance carrier and Marsh Risk and Insurance Services, insurance broker. The surveys focus primarily on fire exposures and reliability of fire suppression systems. Buildings with high value content or replacement cost such as libraries, CIS and Cantor Art are visited annually, along with buildings that have

high business interruption potential such as Cardinal Cogeneration Plant and Forsythe Hall. Other high value buildings from both the University and the Medical School are visited on a four year rotation.

Key Activities

University Fire Marshal's Office has worked with Stanford Risk Management and XL Insurance to escort the inspector when needed. Further, University Fire Marshal's Office meets with Risk Management, Zone Management and Building Managers to assist them in evaluating and responding to fire protection related recommendations.

Trends

It has been over six years since XL Insurance became the insurance carrier. They have been visiting the high exposure buildings annually. In 2009 they began to repeat visits to other buildings. It is anticipated that they will continue to visit the campus annually for about 2 weeks in February or March. The time investment from the University Fire Marshal's Office is anticipated to remain static.

Risks and Mitigations

The primary purpose of the surveys is to evaluate risk related to insured perils which include fire, wind, flood, and water damage caused by fire suppression systems. Stanford University is largely self-insured which means that most property related losses are born internally and any reduction in risk will directly benefit the University. XL quantifies the exposures they identify and the mitigation efforts made by Stanford University have significantly reduced the dollar value of

identified risk. The addition of sprinklers in several existing laboratory buildings, which was done at the prompting of the University Fire Marshal's Office has significantly contributed to risk reduction. Also, University Fire Marshal's Office plays a significant role in attaining risk reduction by providing consulting to Risk Management, Zone Management and Medical School Facilities Managers on fire protection issues which make up the majority of recommendations.

Compliance Issues and Regulations

Most insurance recommendations are not code mandated. Insurance carriers evaluate existing buildings the same way they evaluate new construction. Most recommendations involve existing structures that complied with the code when they were built but may lack fire suppression, or existing fire suppression may not be reliable by current seismic and installation standards.

Future Needs / Challenges

Risk management would like the University Fire Marshal's Office to take a more active role in evaluating and advising on properties acquired by Stanford Land Management. This will tax the current resources of the University Fire Marshal's Office. In addition to providing technical services to campus facility construction projects, University Fire Marshals' Office will need to allow sufficient engineering time to escort the insurance visits and prepare responses to recommendations and inquiries from Risk Management, insurance brokers and insurance carriers.

Liaison with local jurisdictions

Background

University Fire Marshal staff serves as the primary liaison between Stanford University and the local jurisdictions on issues pertaining to fire fighting and code compliance. The importance of this role is compounded by the fact that while Santa Clara County and City of Palo Alto have statutory authority over the Stanford campus and the auxiliary buildings, the Office of Statewide Health Planning and Development (OSHPD) has jurisdiction over the School of Medicine located in Stanford Hospital. Moreover, Palo Alto

Fire Department, by a contractual agreement, provides fire-fighting services to the University. These services also include engine company level fire inspections. The University Fire Marshal's Office works in concert with the multiple jurisdictions to achieve consistency in code interpretation and enforcement

Key Activities

The following will present some of the key activities: Interface with Palo Alto Fire Department (PAFD) and Santa Clara County (SCC) on fire department access

issues; Meet with the local jurisdictions to address and resolve code compliance issues; Conduct joint inspections and fire protection system acceptance tests with local jurisdictions; Follow up with PAFD and SCC to address and abate deficiencies noted during engine company and annual building inspections; Respond to fire-related emergencies to assist PAFD in the investigation of causes and origins of fires; and Pick up fire department emergency response run reports and distribute the information to the appropriate departments



STANFORD UNIVERSITY

including Zone Management and Residential and Dining Enterprise.

Trends

The University's Planning Office, Department of Project Management, School of Medicine, Building and Grounds Maintenance and other internal clients have been channeling fire safety, fire department access, and code related issues through the University Fire Marshal's Office for resolution with the local jurisdictions. This provides a single point of contact for both the jurisdictions and the University to address and resolve these issues. Due to its acknowledged benefit to the University and the jurisdictions, University Fire Marshal's Office will continue to assume this role. The adoption

of new codes in California has led to increased liaison activity with the local jurisdictions as new code interpretations are made and new supplementary local amendments are drafted.

Risks and Mitigations

University Fire Marshal staff has established good rapport with personnel from local jurisdictions through professional interactions. However, high or unrealistic expectations from our clients may at times jeopardize the rapport. It is important to edify our clients regarding possible outcomes of code negotiations.

Compliance Issues and Regulations

As the primary liaison on issues pertaining to code compliance, University Fire

Marshal staff effects institutional compliance with fire codes and regulations.

Future Needs / Challenges

Personnel changes at the local jurisdictions presents a challenge as different or more restrictive code interpretations are made which would necessitate additional time and resources from the University Fire Marshal's Office to address and resolve the code issues. It is anticipated that University Fire Marshal's Office will continue to assume the role of liaison, especially considering the new International Codes which became effective on January 1, 2008.

Maintenance and Testing

Fire Protection Systems and Fire Alarms

Background

Fire alarm systems, fire sprinkler systems, and fire extinguishers are maintained by University Fire Marshal's Office technicians that are trained and certified as required by code, and provide 24 hour on-call service for "after-hours" response and repairs. Technicians are dispatched by the City of Palo Alto Dispatch Center (PADC) using radios, pagers, cell phones, and land-line phones; and contacted directly from the central station software ("Manitou") via auto-text to technician pagers and cell phones. Materials used for repairs are managed by University Fire Marshal's Office technicians and stored on-site at the EH&S service yard; small parts inventories are also stored on the service trucks. Regular maintenance and test scheduling is managed using shared calendaring from Stanford Email and Calendaring client (Zimbra) for each building at intervals as prescribed by Title 19, California Code of Regulations. Maintenance and test records are completed and stored electronically. Records are required to be available for review by local jurisdictions, but are also audited by insurance carriers and sent to Stanford clients when requested. Electronic drawings of building floor plans are maintained showing each device type and location. In 2009, smoke damper testing was piloted with Building Grounds and Maintenance (BGM) for viability and cost. In 2010 smoke damper testing was added to the Fire Alarm maintenance program and funding was transferred from

BGM to EH&S / Fire Safety / Fire Alarm budget to cover these costs.

Key Activities

Normal activities during regular maintenance and testing work include: scheduling work, reviewing work orders, completing test sheets, updating electronic bible sheets, troubleshooting failures, coordinating with contractors, advance notice to building managers, putting systems on test and notifying PADC, repairing / replacing devices, visually inspecting equipment, physically testing functionality, measuring and calibrating equipment, coordinating with other Stanford groups for access & testing, coordinating with other Stanford groups for repairs of auxiliary equipment, classroom training to maintain certifications and technical knowledge, and ordering, receiving and stocking materials

Other services provided by the University Fire Marshal's Office technicians involve technical support activity for capital and departmental projects which include: completing full system acceptance test for all fire alarm systems w/ the contractors and local authorities, installing fire extinguishers, removal of fire alarm, fire sprinkler and fire extinguisher devices during the demolition phase of renovation projects, and working directly with the fire alarm contractor to resolve fire alarm system installation issues

Trends

The University capital plan includes a significant expansion in research space on campus. This has necessitated moving support functions to nearby campus facilities so campus real estate can be developed to meet these research needs. The maintenance and testing program is experiencing increased requests for off-campus servicing. Fire alarm systems are interfaced to control a number of building elements such as fire rated doors, smoke rated partition assemblies, combination fire and smoke dampers, air supply fan units, elevators, door hold open devices, smoke evacuation systems, access controlled doors (card key doors), etc. It is increasingly difficult to test these auxiliary devices without causing interruption to normal building services and occupants. The 2010 edition of NFPA 72 provides standards on new types of signaling systems not previously addressed. A few of these are: In-building Mass Notification, Wide-Area Mass Notification, and Emergency In-Building Communication Systems. The latter system is now required in all new and existing buildings per the 2010 California Fire Code. The mass notification systems are designed to notify and provide instructions to occupants of a local emergency such as a terrorist, shooter, bomb scare, natural disaster, etc. Mass notification systems are not currently required by California



building or fire codes, but this could change in the future. The new standards in NFPA 72 provide regulations on how these systems will be designed, and interfaced with existing systems. The trend will be to install and integrate these systems with the existing fire alarm systems which will require additional training.

Risks and Mitigations

Fires present a significant life safety and property risk to the University community and its facilities. This risk is mitigated by well designed, proper functioning, regularly maintained and tested fire protection systems and portable fire extinguishers.

Compliance Issues and Regulations

Title 19 of the California Code of Regulations requires that all fire sprinkler systems and fire extinguishers be regularly maintained and tested in accordance with the 2006 edition, California amended NFPA 25, "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems" to ensure reliable functionality in the event of a fire. The 2010 California Fire Code requires that all fire alarm systems be maintained in operable condition at all times in accordance with NFPA 72, "National Fire Alarm and Signaling Systems". The inspection, testing and maintenance requirements for sprinkler systems have significantly increased with the adoption of NFPA 25. For example, fire sprinklers depending on their type are now required to have a 1% sample tested every 20 years in some cases. Also, there are new requirements to investigate the condition of the piping interior to ensure obstructions are not present that may block water flow from the sprinklers. These additional requirements have resulted in additional recordkeeping and inspection time.

Future Needs / Challenges

The University 2011-2013 Capital Plan reflects about \$1.9 billion dollars in current and forecasted construction scheduled to start over the next three years 2011-2013.

While this is about 5.6% higher than the prior year's Capital Plan, this includes \$1.1 billion in forecasted construction which is five times higher than the previous Capital Plan. This continued level of construction will further tax current resources of the maintenance and testing program. Regular maintenance of fire alarm systems in Lab buildings interacts with the building management system and requires interruption to the ventilation system while certain devices are being tested such as smoke dampers and duct detectors. As a result, researchers are requiring this work be done after normal hours to mitigate potential problems with experiments. This has significantly increased the level of maintenance work scheduled during the winter closure. Currently all (6) alarm technicians and (2) sprinkler technicians are scheduled during the winter closure to meet these demands.

The new construction and off-site facilities will drive the need for additional resources and added technicians to carry out the key activities of the maintenance and testing program. The increased integration of the fire alarm system with the building systems, the research need to reduce interruptions, and the increased building square footage moving forward all are taxing current technician workloads; additional alarm and extinguisher technicians will be required to address these factors. Moreover, the current existing space allocation in Building C for the fire systems technicians is at maximum. Expansion of the existing space will be required to accommodate the additional technicians required to maintain service levels.

Fire Alarm Systems

There are over 450 buildings with fire alarm systems which are maintained semi-annually as required by NFPA 72 which is referenced by Title 19, California Code of Regulations. Devices maintained include smoke detectors, heat detectors, monitor and control modules, power supplies, control panels, batteries, and building

evacuation notification devices. Areas serviced include all of campus, some nearby off-campus facilities such as Porter Drive, the Boat House in Redwood City, and Hopkins Marine Station in Pacific Grove. Additionally, smoke damper testing and recordkeeping is being done for the BGM maintained facilities.

Fire Sprinkler Systems

There are 375 buildings with fire sprinkler systems which are maintained on a quarterly basis as required by National Fire Protection Association (NFPA) 25, recently amended by Title 19, California Code of Regulations. System components include sprinklers, piping, hangers, seismic bracing, control valves, drain valves, pressure gauges, fire pumps (where provided), fire department connections, check valves, inspectors test valves, spare sprinkler equipment box, hose valves, and signage. Areas serviced include all campus buildings, 1450 Page Mill Rd, Newark Warehouse in Newark, Provost House in Menlo Park, and SLAC Guest House.

Fire Extinguishers

There are over 8800 fire extinguishers maintained on an annual basis with "tear-downs" now required every six years and hydrostatic tests of CO₂ extinguishers done every five years. Areas serviced include all campus buildings, School of Medicine buildings (on and off campus), and SLAC.

Inventory Management

Management of the spare parts inventory is currently done manually by the technicians of each trade: spare parts for alarm systems are managed by the alarm technicians; spare parts for the sprinkler systems are managed by the sprinkler technicians, etc. Bulk inventory is maintained in two separate modular units located in the EH&S service yard. One container houses the fire alarm spare parts and the other container houses both the fire sprinkler and fire extinguisher spare parts. Parts are received at the ESF Facility, Building A or C.

Remote Fire and Intrusion Alarm Monitoring Station

Background

The status of the fire alarm and fire sprinkler systems including alarm, supervisory and trouble signals from each

Stanford building with fire alarm systems are monitored by the Remote Fire Alarm Monitoring Station located in Building C of the ESF Facility and automatically

reported at the Palo Alto 911 Emergency Dispatch Center. There are a few buildings that are also monitored for intrusion such as Cantor Arts, EH&S,



STANFORD UNIVERSITY

Packard Engineering, and GSB South. The fire alarm and sprinkler system, and intrusion alarms are monitored constantly to ensure proper operation of the systems, and timely fire and police department response to emergencies.

The monitoring station consists of automation software and computer hardware (aka "Manitou") that is networked to the 911 Palo Alto Dispatch Center (PADC). The monitoring station at ESF Facility Building C consists of the following equipment: computer servers, network equipment, database files, various receivers, data transmission lines, antenna's and wireless radio receivers, uninterruptible power supplies, and workstations. The monitoring station can be accessed remotely by the Fire Alarm Technicians using phones or the internet. The monitoring station receives signals from the protected Stanford buildings by wireless radio transmitters located at the protected building. The monitoring station then transmits these signals using a dedicated T1 data line to a remote workstation at PADC and simultaneously to EHS workstations via the network. The PADC remote workstation is monitored 24 hours/day, year round by trained 911 Police and Fire dispatchers and is part of the Fire Safety monitoring network. There is also an EH&S laptop at the PADC that can be readily connected via VPN should the T1 line fail to maintain signal monitoring from EHS.

Key Activities

Operation of the remote alarm monitoring station involves: wireless radio transceivers; maintaining the various servers, monitors, UPS devices, receivers, connections, etc.; maintaining the wireless head-end equipment – Antenna's, cables, RF filters, etc.; assisting and testing Manitou system software upgrades from Bold Technologies; assisting PADC during Manitou network troubles, power outages, etc.; developing and maintaining Manitou email reports & text lists; programming zone schedules into Manitou servers; data

entry of alarm system devices; creating new building alarm account files; putting systems or zones on test; re-setting system after it goes off-line; retrieving history files to verify test signals; troubleshoot receiver failures; monitor alarm "traffic" when PADC communication line fails; review building alarm history to troubleshoot nuisance alarms; and verify signal traffic with technicians in the field.

Trends

The "Manitou" central station (automation) system which includes a dedicated Microsoft network incorporating a remote workstation at PADC has resulted in significantly increased communication reliability with PADC. Prior to being networked, a dial-up modem connection was used to send signals to PADC.

Risks and Mitigations

The remote fire alarm monitoring system has many redundant features, including emergency backup power and uninterruptible power supplies that provide a high level of reliability. However, with all the key components being housed in Building C, it presents a risk of losing the connection to PADC should Building C be severely damaged in an earthquake, terrorist attack, or fire. This would result in loss of alarm signals being automatically transmitted to PADC and delayed fire department response. This risk is mitigated by the local audible alarms on the exterior of each sprinklered building and interior audible and visual alarm notification devices which would alert the building occupants and nearby pedestrians to phone the fire department.

Compliance Issues and Regulations

The 2007 California Fire Code Section 903.4 requires that all buildings with more than 20 sprinklers send monitoring signals automatically to a central station or remote monitoring station.

Future Needs / Challenges

Completion of the wireless radio installations is the most immediate challenge while maintaining all other aspects of the fire safety program. The new automation software will allow more flexibility in handling each type of fire alarm signal transmitted from the protected building. There will be a need to review existing standard operating procedures to leverage on this flexibility as well as the other features provided by the new system.

Wireless Radio Transmission

There are currently 297 wireless radio units installed throughout campus. This was a result of a four year upgrade project. In a continued effort to explore and implement new technology, the University Fire Marshal's Office begun to install a new AES IntelliNet wireless radio mesh network on campus in January 2007. Traditionally, transmission from the protected buildings to the remote monitoring station had been done using either BASE 10 or DMP dialers. Both of these use underground wires to transmit signals to the remote monitoring station. The new system uses no wires and represents the latest technology in fire alarm and intrusion signal transmission. The AES IntelliNet wireless system uses wireless radio transceiver units which currently provide 100% of the signal transmission from the fire panels of the protected buildings. These units serve both as a transmitter and receiver, and operate under a dedicated radio frequency licensed with the FCC. These radio units have a "line-of-site" range of about two miles and since they "talk" to nearby radio units installed in other buildings, all-together they form a wireless mesh radio network that creates multiple transmission paths between the protected building and the remote monitoring station at Building C. This presents a highly reliable and economical replacement of the legacy BASE 10 and DMP dialer technology. Final installation of all wireless radios in existing buildings was complete by October 2010.

Training

Background

The University Fire Marshal's Office provides training to the Stanford Community on general fire safety and use of portable fire extinguishers. Specific

topics such as Laboratory Occupancies and Update on International Building and Fire Codes were presented to Project Managers in Department of Project Management and School of Medicine.

Training was also provided to faculty members and students on the safe transportation of hazardous materials from McCullough Building to the Moore Building.



STANFORD UNIVERSITY

Key Activities

University Fire Marshal staff participates regularly in several training presentations. **Fall New Student Safety Training** teaches individuals about the types of fire extinguishers and how to use them, and general fire safety topics. Topics include: Chemical Storage and Fire Safety and General Fire Safety. **Fire Extinguisher Use** (quarterly) provides hands-on experience using a portable fire extinguisher. Training is also provided throughout the year to the various Schools and Departments that request it. **Party Planning Workshops** (quarterly) are hosted by the Office of Student Activities. During the workshops students are instructed on fire safety regulations. Fall training is also provided to **Graduate Housing Community Assistants** and **Undergraduate Housing Resident Assistants**. Staff also conduct **building evacuation drills**.

Trends

Due to the specific fire hazard associated with the kitchen work environment,

University Fire Marshal's Office has expanded the Fire Safety Training Program to include kitchen staff of Residential and Dining Enterprises. As more Department Administrators are educated about the importance of emergency preparedness, there will be an increase in the number of evacuation drills conducted by the University Fire Marshal's Office.

Risks and Mitigations

Hot work takes place on the Stanford campus every day. There are contractors, staff and students working on campus projects conducting hot work not in compliance with the California Fire Code Art. 49. This presents a regulatory risk as well as a safety risk since there have been incidents of fires caused by hot work. The University Fire Marshal's Office has provided Hot Work training to Buildings and Grounds Maintenance and Housing Department.

Compliance Issues and Regulations

Per Cal/OSHA 8 CCR 6151 (<http://www.dir.ca.gov/title8/6151.html>), whenever portable fire extinguishers are

provided for the use of employees, the employer shall provide an educational program to familiarize employees with the general principles of fire extinguisher use and the hazards involved with initial stage fire-fighting. The educational program shall be provided upon initial employment and at least annually thereafter. Presently, an on-line fire extinguisher training video is available for viewing.

Future Needs / Challenges

The Santa Clara County-wide amendments to the new International Fire Code which became effective on January 1, 2008 require quarterly evacuation drills for student residences. In the past, these drills were required on an annual basis. The drastic increase in the frequency of the evacuation drills will further tax the resources of the University Fire Marshal's Office. In order to verify learning, on-line training for Fire Extinguisher Use in addition to the fire extinguisher video should be implemented. University Fire Marshal's Office will work with the Training and Communications Specialist to develop the course.

Fire Investigations

Background

While Palo Alto Fire Department, per contractual agreement with the University, has primary responsibility for fire cause investigations on campus, University Fire Marshal staff are on-call 24 hours/day year-round to respond to fire emergencies and conduct joint post-fire investigations as needed with Palo Alto Fire Department and Department of Public Safety depending on the severity of the incident.

Key Activities

Palo Alto Dispatch Center (PADC) provides timely notification to University Fire Marshal staff of fire incidents on campus where Palo Alto Fire Department has responded. For fire incidents in Housing facilities such as student residences, University Fire Marshal staff will relay the information to Housing so that post fire remedial actions can be implemented. As part of the post-fire investigation, University Fire Marshal staff will determine if the building fire protection system has functioned properly and whether there are issues related to emergency response.

Trends

While fire incidents are largely unpredictable and they can happen anywhere and anytime on campus, an aggressive fire safety training program targeted to a broad audience will help keep the number of fires on campus in check.

Risks and Mitigations

The causes of fires on campus are reviewed by the University Fire Marshal's Office. In accidental caused incidents, recommendations are made as to how such incidents can be prevented from recurring in the future. Recurring incidents may prompt a campus awareness campaign as well as the need for additional safety training in a specified area.

Compliance Issues and Regulations

Fire investigations disclose that some fire incidents stem from non-compliance with the Fire Code and regulations. For instance, Hot Work and use of extension cords not in compliance with the Fire Code has resulted in fires.

Future Needs / Challenges

Conducting fire investigations on campus outside of normal working hours can be challenging to the University Fire Marshal's Office since not all staff live in close proximity to the campus. Also, in past fires such as a transformer fire in one of the School of Medicine leased facilities, University Fire Marshal staff prepared a detailed investigation report. While the report was presented to Palo Alto Fire Department as requested, the latter failed to provide their investigation report to the University Fire Marshal's Office. Further, while PADC has an agreement with the University Fire Marshal's Office to provide timely notification of fires on campus to the University Fire Marshal's Office on-call staff, the agreement has not always been followed rigidly. These issues need to be broached with both Palo Alto Fire Department as well as PADC. It is anticipated that the University Fire Marshal's Office will continue to play an important role in fire investigations. When training classes are available, staff will be sent to fire investigation classes to acquire more skills. Also, emphasize will be made



during fire safety training presentations on

the cause of fires and preventive measures.

Special Event Planning

Background

The University Fire Marshal's Office has consistently provided fire safety information to various groups and departments throughout the year. Fire Safety information is available on the EH and S web page. Since 2004 University Fire Marshal's Office has purchased Flamort Fire Retardant and re-sold it to students, at same cost. The availability of the fire retardant on campus has increased the use of this material ensuring that decorations for student parties are treated per the fire code.

Key Activities

University Fire Marshal staff work in conjunction with the Office of Student Activities and Leadership, Residential Education, Events Planning, and the Dept. of Public Safety to ensure that special events and student parties are conducted per the fire code and University Guidelines.

Events Planning. The University Fire Marshal's Office is involved in the fire safety planning of several annual special events that occur on campus each year. The events are varied and include but are not limited to the American Indian Pow-Wow, Big Game Week events, Commencement, Career Fair, and Stanford Concert Network events.

Student Parties. University Fire Marshal staff meets bi-weekly with the Office of Student Activities and Leadership to review registered student parties. SUFMO ensures that parties register the correct capacities for the facilities that will host

the party to ensure there will not be any overcrowding. University Fire Marshal's Office also sells fire retardant solutions to students and conducts a pre-party inspection where the treated decorations are tested. University Fire Marshal staff participates in quarterly Party Planning Workshops hosted by the Office of Student Activities. During the workshops students are instructed on fire safety regulations. There are several parties that are hosted annually; they include the Mausoleum Party, Sigma Nu's MoonSplash Party in the fall and the SunSplash party in the spring, 680 Lomita's Exotic Erotic Party, SAE's Roman Bath Party, and Sigma Chi's Cowabunga Party.

Trends

Stanford University is an internationally known campus that attracts domestic and foreign dignitaries as well as celebrity appearances to its various venues each year. The ability for the campus to host safe events and parties is essential for the students and many guests that visit each year. With the growing popularity and availability of multiple venues on campus there is a growing trend where several large events are scheduled simultaneously on campus.

Risks and Mitigations

Any event or party that involves alcohol poses risks to the students who attend these functions. When students consume alcohol it inhibits their reaction behavior to exit a facility they may not be familiar with. The requirement for sober monitors at each student party is a mitigation to ensure that

all students will exit the building in the event of a fire.

Compliance Issues and Regulations

To ensure compliance with the fire code, University Fire Marshal staff inspects parties when fire retardant has been purchased. This ensures that the party decorations have been treated and made flame retardant. An inspection of the facility is conducted to ensure that exits are unobstructed and to ensure that fire protection equipment such as fire extinguishers, fire alarm pull stations and horn-strobe devices, and exit signs are not concealed by any decorative materials. Occupant load limits are reviewed to ensure that overcrowding does not occur and instruction are given to party planners on how to react in the event the fire alarm is activated. For large campus parties, Palo Alto Fire Department Engine 6 is invited to attend the pre-party inspection.

Upcoming Issues and Challenges

Inspection of campus events and student parties are often conducted outside of normal working hours. Frequently University Fire Marshal staff must return to campus during the evenings or on the weekend to conduct safety inspections. Challenges occur during certain weekends each year when there are several large events that are scheduled simultaneously. With the many events and lectures hosted on campus throughout the year, overcrowding will be an issue that needs to be addressed collaboratively with the event planners.

Facility Design and Construction Standards

Background

The Stanford University Facility Design Guidelines (FDG) is a set of guideline design documents, technical specifications, and detail drawings to be used by architects, consultants, and contractors in the design and construction of new and remodeled buildings on the Stanford campus.

Key Activities

The University Fire Marshal is a member of the Facility Design Guidelines Committee which review and develop new guidelines and specifications as needed. University Fire Marshal's Office is responsible for maintaining the fire protection related guidelines and specifications including Fire Sprinkler Systems, Fire Alarm systems, Fire Pumps, Fire Extinguishers and Knox Boxes et al. Previous tasks also include collaborating

with other EH and S programs in developing the Laboratory Design Guideline.

Trends

Due to periodic changes in regulatory requirements and development in new technology and products, it will be critical to review and update the FDG on a regular basis.



STANFORD UNIVERSITY

Risks and Mitigations

Conformance to the fire protection specifications and guidelines ensure consistency of the equipments installed and their serviceability, thus minimizing the risks of system malfunction.

Compliance issues and regulations

Conformance to the FDG is conducive to regulatory compliance.

Future Needs / Challenges

Budget constraints of certain facility renovation and construction projects at times make it challenging to enforce the FDG. SUFMO staff would make an effort to come to resolution so that no major risks

result from non-conformance with the FDG. Buildings and Grounds Maintenance has requested the University Fire Marshal's Office to test Fire and Smoke dampers installed in buildings, which drives the need to prepare a set of specifications for Fire and Smoke Dampers.

Code Development

Background

University Fire Marshal staff actively participates in the networking process relating directly to code development and application. Through memberships in the Santa Clara County Fire Prevention Officers Association and the Northern California Fire Prevention Officers Association, the Stanford Fire Marshal's Office plays a direct role in the code development process. Both professional associations offer direct interaction with members of other fire prevention bureaus whose experiences with specific code issues serve as a resource for clarification on technical issues. This communication also lends itself to early awareness of upcoming code changes, which is extremely useful in preparing for changes that directly impact the campus as well as by keeping all staff members fully informed of the code development process. Through Class A voting membership with the International Code Council, the University Fire Marshal's Office can submit and effect code changes to achieve better code or better code interpretations that apply to educational institutions.

Key Activities

University Fire Marshal staff participated in the task force under the oversight of the State Fire Marshal to revise the H-8 (laboratory) occupancy requirements to be included as State Fire Marshal

amendments in the new 2007 California Building Code which became effective on January 1, 2008. Stanford University presently has three (3) science buildings that are classified as H-8 Occupancies: Clark Center, CCSR and Astrophysics. University Fire Marshal staff also participated in the development of Santa Clara County-wide local amendments to the new California Fire Code.

Trends

The International Building and Fire Codes became effective on January 1, 2008. Since these Codes have not been tested in the State of California, it is anticipated that more State and local amendments to the Codes will be issued in the coming months and years. The University Fire Marshal's Office will continue to stay actively involved in the code development process.

Risks and Mitigations

Through the University Fire Marshal's active participation in the new code development and amendment process, the University's interest is represented. Moreover, the University's regulatory risk is also minimized.

Compliance Issues and Regulations

While codes are intended to safeguard life and property, jurisdictions who write the codes are not always knowledgeable with scientific research and the associated

equipments. These codes, once adopted, may have adverse effects to health safety. The proposed Santa Clara County wide local amendment to the new International Fire Code requires internal fire sprinklers be provided in bio-safety (BSC) cabinets. The sprinklers, if activated, can spread infectious microorganisms beyond the confines of the BSC, resulting in a serious health safety hazard to emergency responders and the surrounding environment. The University Fire Marshal's Office through interactions with the local jurisdictions was successful in getting the proposed amendment changed.

Future Needs / Challenges

The California Building and Fire Codes are revised every three years by order of California legislature, with supplements issued in intervening years. The University Fire Marshal's Office must stay apprised of the upcoming code changes and inform the University's stake holders on how the code changes will impact design and operation of a building. The University Fire Marshal's Office will continue to network with model code organizations, State and local jurisdictions on code development issues. Proposals will be made to jurisdictions to effect code revisions applicable to research lab environments.



Air Emissions
 Hazards Materials Spills
 Sustainability
 Wastewater Discharge

Environmental Protection

The management of chemical and radioactive hazardous wastes, chemical releases and their environmental impacts are regulated by federal and state EPA and local regulatory agencies such as the Bay Area Air Quality Management District (BAAQMD), County of Santa Clara Department of Environmental Health, and the Regional Water Quality Control Board. The Environmental Management Program reviews regulations, determines the applicable requirements, implements activities needed to maintain compliance, and works with the agencies to improve regulations..

Supports these University Units:	Technical Services Provided	Business Drivers
<ul style="list-style-type: none"> • Research Laboratories and Clinics • Facilities Service Operations • Construction / Renovation 	<ul style="list-style-type: none"> • Hazardous Waste • Air emissions • Wastewater discharge • Hazardous Material Spill Prevention and Response • Historical Releases • Plan Reviews • Sustainability 	<ul style="list-style-type: none"> • Environmental Protection Agency (EPA) • Bay Area Quality Management District • County of Santa Clara Department of Public Health • Regional Water Quality Control Board



Program Elements

Overview

Hazardous Waste	Air Emissions Source Permitting, Compliance, and Risk Assessment	Wastewater Discharge Management and Compliance	
<ol style="list-style-type: none"> 1. Training 2. Identification and Characterization 3. Container labeling 4. Accumulation 5. Container pick-ups 6. Environmental Safety Facility (ESF) compliance requirements 7. Chemical hazardous waste (management and disposal) 8. Surplus chemicals 9. Radioactive waste 10. Universal waste 11. Long-term liability 12. Waste minimization planning 13. Regulatory review and Advocacy 	<ol style="list-style-type: none"> 1. Source Permitting 2. Source Compliance 3. Risk Assessment 	<ol style="list-style-type: none"> 1. Waste Management 2. Hazardous Materials Response 3. Permits 	
Hazardous Material Spill Prevention & Response	Historical Releases	Plan Reviews	Sustainability
<ol style="list-style-type: none"> 1. Hazardous Materials Response Team 2. Training 3. Reporting Releases 4. Toxic Gas Response Plan 5. California-Accidental Release Plan for the Central Energy Facility Ice Plant 6. Spill Prevention Control and Countermeasures (SPCC) Plan 	<ol style="list-style-type: none"> 1. Risk Evaluation 2. Remediation activities 3. Closure plan 4. RCRA Facility Assessment 	<ol style="list-style-type: none"> 1. Hazardous Materials or Environmental issue identification 2. Regulatory impact evaluation 3. Mitigation strategies 	<ol style="list-style-type: none"> 1. Bottle water replacement initiative 2. Food Waste composting pilot program

Hazardous Waste

Introduction

The fundamental goal of the Hazardous Waste Program (HWP) at Stanford is to provide the necessary support to ensure that the University conducts its educational and research missions in compliance with applicable laws and regulations governing management of chemical, radiological and biological hazardous waste. The programs and activities of the HWP have been designed to promote protection of human health and the environment through effective and efficient management of hazardous waste from the moment it is created until its final disposition. Additionally, the program seeks to minimize the administrative impact to research and other entities while ensuring

appropriate waste disposition from those activities. Finally, the programs are designed to minimize the long term liability associated with improper disposal. The major operational elements of the program include:

1. **Electronic Service Requests.** User friendly on-line system for use by waste generators in preparing a compliant chemical waste label and requesting waste pickup.
2. **Waste Accumulation Containers.** A variety of regulatory compliant containers meeting user needs are provided to waste generators for both radiological and chemical hazardous waste.
3. **Waste Transportation** - environmentally protective and safe movement of all wastes from generating locations to the central Environmental Safety Facility (ESF).
4. **Lab Cleanout Services** - designed to be a cost effective and convenient methodology for disposal of large quantities of wastes generated as a result of renovations and moves.
5. **Patient Room Cleaning and Surveys** - providing room cleaning and radiological surveys in areas where radioisotopes have been administered to patients.
6. **Construction and Mixed Wastes** - monitoring on-campus accumulation of construction and mixed radiological



and chemical wastes to ensure time limits are not exceeded.

7. **Interim Chemical Waste Storage** - temporary storage of chemical wastes at the ESF facility for less than 90 days.
8. **On-site Decay of Radioactive Waste** - maintaining and operating a building at the ESF facility to hold short ½ life materials, such as 32P wastes, for decay until they are no longer radioactive.
9. **Surplus Chemical Redistribution and Solvent Recycling** - usable chemicals are accepted into inventory at ESF and HWP provides them to users free of charge upon request. HWP redistills select used solvents and returns the usable material to labs free of charge.
10. **Universal Waste Management** - HWP manages fluorescent tubes and a variety of Universal wastes for shops and other non-lab generators
11. **Off-Site Disposal of Hazardous Wastes** - HWP packages and ships all hazardous wastes for final disposal at environmentally protective disposal facilities located in a variety of U.S. locations.
12. **Environmental, Health and Safety Reviews of Disposal Sites** - HWP reviews the operations and compliance of waste disposal contractors to ensure that long-term liability to the University is minimized.
13. **Hazardous Material Spill Response** - by maintaining a small group of trained HazMat response technicians, HWP responds to routine and non-health threatening spills and releases of chemical, biological and radiological materials.
14. **Review of New and Proposed Laws and Regulations** - HWP provides input on behalf of the University when appropriate.

The Hazardous Waste Program also serves the University by providing the following written guidance, training, and individual assistance to waste generators:

- **Written procedures** regarding management of hazardous wastes in a manner that protects the health and safety of faculty, staff, students, and the environment, complies with government regulations, and minimizes long term liability to the University;

- **Consultation** services to lab, clinical, and shop generators regarding proper management of wastes, and to suggest cost containment strategies to reduce the occurrence of costly wastes, such as mixed radioactive and chemical wastes. This also includes identification and segregation of hazardous waste from non-hazardous materials;
- **Technical advice** to waste generators regarding potential methods of reducing the quantity, toxicity and radioactivity of hazardous waste generated to the lowest practicable level; and
- Providing expert assistance regarding **equipment selection and operational procedures** designed to prevent spills and releases of hazardous materials.

Training

Background

(Regulatory driver: 22 CCR 66265.16, 10 CFR 20.1101(a)) Hazardous waste regulations require that waste generators are knowledgeable of the requirements for properly managing hazardous wastes while in the labs, shops, clinics and studios. It is a performance standard. In addition, individuals responsible for managing waste at central facilities like ESF are required to receive additional, annual, documented training.

Key Activities

Environmental Protection Programs (EPP) designed and implemented the Chemical Waste portion of the EH&S on-line Chemical Safety training course to provide lab waste generators with knowledge and tools to properly and efficiently manage their waste prior to pickup by HWP. EPP has also worked with the Safety and Compliance Assistance program to distribute informative posters summarizing all the required knowledge and procedures to all labs. EPP provides annual classroom training to all individuals who manage hazardous waste at the ten central collection areas at Stanford. This training is documented in STARS. Health Physics provides radiation safety training to all individuals using radiological materials and generating radioactive waste.

Future Needs / Challenges

An on-line class is needed that is specifically tailored to shops. EPP will

work with OH&S to develop this training as part of an on-line chemical safety course for shops. A classroom like space, with A/V equipment, is needed for providing in-person training. This space currently exists at ESF.

Identification and Characterization

Background

(Regulatory driver: 22 CCR 66262.11, 10 CFR 20.2001) The first step in managing University wastes in an environmentally responsible manner is identifying which wastes are hazardous and thus require specialized handling and disposal. This is accomplished by the EH&S Waste Program by applying Federal, State, and Local regulations to the immense variety of materials used on Campus. In general all wastes generated in a laboratory setting in California are considered hazardous so identifying these materials is the primary task performed.

Key Activities

Chemical Waste

Identification for chemical waste typically exists in 2 broad categories; identifying whether or not laboratory waste is hazardous and identifying items found in the laboratory setting without the required label.

1. **Hazardous Waste in the Lab** - California regulations require that all wastes produced in a laboratory environment are considered hazardous until proven otherwise. Lab and shop generators are the primary source of information for determining if a waste is hazardous. HWP has used generator supplied data, testing and other methods to review over 1,000 commonly generated wastes at Stanford, and if not hazardous, placed them on the non-hazardous waste list. Accomplishing this task may also involve sampling of materials suspected of not being hazardous, doing simple tests for characteristics, and sending samples off-site for certified analysis. The testing process requires use of a hood and a basic laboratory set up. For more information, refer to



STANFORD UNIVERSITY

<http://www.nonhazardouswaste.stanford.edu>.

2. *Unknown Materials* – Occasionally chemical containers or vessels will go unlabelled and the identity of the contents becomes lost as personnel transfer or labs are renovated. In these cases, an HWP chemist will attempt to find out as much information as possible about the type of research, who might know about the containers, and what items were typically present in the lab. If all other information gathering doesn't produce a clear identification the chemist will conduct a variety of simple tests that are verified by an outside service vendor.

Radioactive Waste

Radiation users must keep an inventory of the radioisotopes in their possession, and wastes are a part of that inventory. Accordingly, radioactive waste containers are generally properly labeled with isotope and activity data. In those rare cases when unknown radioactive wastes are found, EH&S can take measurements to determine enough information to ensure proper disposal.

Mixed Waste

Radiation users occasionally generate radioactive wastes also containing hazardous chemicals such as methanol. In these cases, lab users provide both chemical and radiological identification data following the procedures noted above.

Future Needs / Challenges

The non-hazardous waste list needs updating to include recent waste determinations. We don't anticipate the need for any significant additional space to facilitate the waste identification and characterization element of the waste programs.

Container Labeling

Background

(Regulatory driver: 8 CCR5194(f)(4), 22 CCR 66262.34 (f) and 10 CFR 20.1904(e)) As part of the Cal/OSHA hazard communication standard, and hazardous waste requirements, waste materials must be labeled in such a way that hazards are identified and appropriate hazard warnings are visible. This is accomplished by filling out and attaching Stanford's standard hazardous waste tag or

by generating a tag using Stanford's on line hazardous waste request software. Proper identification of waste containers is essential to the appropriate handling of all hazardous materials and is a closely scrutinized by inspecting agencies.

Key Activities

Chemical waste containers in the laboratory or other University operated facilities are tagged for identification in one of 2 basic ways. A hand written multi part tag is attached or a computer generated tag is printed.

Hand Written Chemical Waste Tag

Stanford's standard Hazardous Waste Tag is a multipart form whereby the generator of any hazardous waste fills in specific hazard information and then attaches it to the container either by tying a string or sticking the adhesive backing to the waste container. These have been mass produced for many years and served as the primary means of identifying hazardous waste on Campus.

Computer Generated Chemical Waste Tag

One component of the electronic Hazardous Waste Management software that the waste program is currently implementing is the production of hazardous waste tags using information entered prior to the pickup request process. This has offered generators of hazardous waste an easier and more straightforward means of labeling their container. In addition, it ensures that all required data is included on the label. More and more laboratories are now using this system and we anticipate full implementation and complete phase out of hand written tags in the near future.

Radioactive Waste

The generator must complete and attach an inventory sheet listing all nuclides and the associated activity.

Future Needs / Challenges

As waste tag labeling becomes more of a product of electronic requests the need for IT support is sure to increase. As more work groups at the University make use of the on line requesting software we anticipate the need for more Information Technology support as new issues or bugs appear.

Accumulation

Background

(Regulatory driver: 22 CCR 66262.34, H&S Code 25200.3.1, 10 CFR 20.2001) California law and regulations provide requirements designed to protect human health and the environment while hazardous wastes accumulate. The locations for accumulating these wastes are defined as "Waste Accumulation Areas (WAA's)" or Satellite Accumulation Areas (SAA's)". The accumulation time limits, maximum accumulation volumes, and management requirements depend on the type of area. In general, Stanford relies on the SAA methodology in our laboratories and shops because it allows greater flexibility for the small amounts generated and accumulated, and allows for accumulation for up to nine months. Radioactive waste regulations are performance based as opposed to establishing any specific requirements regarding accumulation prior to disposal. Notably, there is no time or volume limit on accumulating radioactive waste in labs. Since the license requires each researcher to track and account for their nuclides, radioactive wastes are accumulated in the lab where the research is performed. The performance based standard requires the licensee to develop a program which will keep exposures to radioisotopes "as low as reasonably achievable" (ALARA). Waste containers must be surveyed to assure that ALARA has been achieved.

Key Activities

Waste generators are responsible for management of waste accumulation areas in labs and shops. EH&S has developed specific guidance and training for lab SAA's and central WAA's. Requirements for SAAs are contained in the on-line "Chemical Safety for Labs" course developed by EH&S. The HWP provides live training for WAA personnel, and maintains a compliance file for each WAA, including the name of the responsible person, a written emergency plan, and inspection requirements. Requirements applicable to radioactive waste generators designed to reduce exposures are contained in the Radiation Safety Manual and the Radiation Safety course offered at EH&S.

Avoiding Abandoned Waste: Laboratory personnel, who move from one lab to another or leave the University, are



instructed to have all unwanted chemicals and isotopes in their control disposed of through the Hazardous Waste Program prior to making the change. HWP guidance instructs that chemicals should never be left behind for another person to dispose of. The on-line “WasteTag” system tracks each chemical waste container in the system and notifies the generator to request pickup when the container is approaching 8 months old. If the generator fails to submit a request, the system automatically generates one when the container is nine months old. The departments are responsible for lab deactivation costs if laboratory personnel have not disposed of hazardous chemical and radioactive wastes appropriately and the failure to act requires EH&S to expend additional resources.

Future Needs / Challenges

Stanford has been very involved in various task forces and initiatives to provide regulatory relief regarding requirements for managing hazardous chemical wastes while they are in laboratories. To date, there has been wide recognition by regulatory agencies that the requirements devised for manufacturing facilities do not accommodate the needs of research, and Federal EPA has issued a streamlined waste management program for academic laboratories. California has yet to approve this program so it cannot be used in California. By continuing to expend resources in working with other institutions, industrial research consortiums, and government, Stanford can be an important voice in streamlining the requirements and reducing unnecessary burdens on research.

Container pick-ups

Background

(Regulatory driver: 22 CCR 66262.34(a), and 10 CFR 20.1101(a)) In order to ensure that labs and other waste generating locations comply with the mandated time limits, and to reduce risks posed by unknown or “legacy” wastes, the HWP has developed a user friendly and responsive waste pickup program.

Key Activities

The waste generator utilizes the on-line WasteTag system to initiate a pickup of research and academic generated chemical waste. The Oracle based eAm system, currently under construction, will be used

for requesting pickups of radioactive and non-research generated chemical wastes. CWP employs two types of pickups: Blanket requests, and Standard requests. RWP requests are processed as received.

Chemical Waste Standard Requests

Users submit a request once the container is full, is over 8 months old, or they want it removed for space or other considerations. Waste containers labeled through the WasteTag system are tracked by the system, and a pickup request is auto-generated when the item is 8 months old.

Chemical Waste Blanket Requests

Provided to labs and shops consistently generating a volume of waste sufficient to warrant a routine weekly or bi weekly stop by our pick up crew. The requests are automatically scheduled by HWP; the generator does not need to submit a request. Upon arrival at the generating location, HWPP removes all properly labeled non-leaking waste containers found in the agreed accumulation area, typically a hood or storage cabinet.

Non-Research Requests

Disposal costs for wastes generated by non-research activities are not covered under the department’s overhead budget, so a modified approach to waste pickups has been created. The waste crew conducts monthly pickups at select satellite locations, mainly LBRE Shops and Athletics. While at the site, the crew identifies any waste compliance issues to be addressed and informs the site contact of these issues, which improves compliance with waste storage regulations. These locations are overseen by non-research staffs that are generally less familiar with waste compliance issues. The crew documents the size and constituents of each waste container, and the generator of the waste. This information is transferred to a spreadsheet for subsequent billing of shop-related wastes. The waste is then comingled with research wastes to take advantage of economies of scale when packaging waste. On a quarterly basis, each shop is billed for labor and disposal costs related to all wastes picked up in the previous quarter.

Radioactive Wastes

The generator submits a completed container inventory sheet to the RWP when the container is nearly full. This sheet is also the pickup request.

Lab Cleanouts

Typically associated with a move or remodel of a laboratory clean outs are scheduled within the normal work flow whenever possible. Users work with the CWP crew to assure that any deadlines are met and that materials left unmarked or labeled are identified by prior occupants of the space.

Future Needs / Challenges

Ninety five percent (95%) of all waste requests are completed within 20 working days. Upon collection in the labs and shops, HWP staff transport containers back to our centralized storage and packaging facility in a specially equipped truck. It is their task to assess if any container is suitable for transportation. This includes assessing the quality and condition of the container, whether or not it is compatible with the constituents, whether or not the contents are fully contained, and whether or not the waste is adequately identified (not unknown). Any container not meeting these standards is left behind to be re containerized or properly labeled by the generator. Typically the technicians will inform the personnel in the area that this needs to be done. On rare occasion a note to that effect is left with the container describing why it could not be transported and providing contact information.

Hazardous waste vehicles need to be securely stored overnight to deter theft. Currently the primary hazardous waste vehicles are parked in the secured service yard overnight.

The speed with which hazardous waste containers are removed from a laboratory or work area (Turnaround Time or TAT) is significantly dependent upon the number of vehicles available to facilitate this process. Acquisition of a second vehicle for use in waste pickups would allow for additional services to be provided

Environmental Safety Facility (ESF)

Background

(Regulatory driver: CCR22.66262.34(a)) Chemical hazardous wastes are received and sorted according to their hazard classifications and chemical compatibility and placed into chemical storage “cells”



specifically designed to meet applicable safety and chemical storage standards. A variety of regulatory bodies oversee the operation of the centralized hazardous chemical waste storage and packaging facility. The primary issues revolve around compliance with time limitations, safe and compatible storage of wastes within the designated “cells” of the Environmental Safety Facility (ESF), and preventing or containing all releases, promptly cleaning up any spilled material

Key Activities

Maintaining the facility in a compliant manner requires a variety of policies and procedures to ensure all the appropriate regulatory issues are addressed. Most significant among these are the weekly inspections to check for exceeding time limitations, assessment of proper compatible storage, and the maintenance of safety procedures including the use of proper protective equipment.

Time Limitations

Hazardous chemical waste must be removed for disposal from the University in general within one year and removed from the centralized facility (ESF) within 90 days. Labels are affixed to each waste container as it is generated indicating the start date for the one year time limit of residency at the University as a whole, an additional sticker is applied to each incoming container at the ESF designating when the 90 day clock starts. Staff routinely checks these dates as they package material to ensure nothing has been on site too long and the dates on all containers in the facility are routinely checked and inspected.

Compatible Storage

As a guard against potentially hazardous reactions that might occur if 2 or more containers are broken and their contents are mixed each container of hazardous waste is transported and stored in such a way that it is only near compatible wastes. The ESF storage cells are set up in such a way that any incoming material will have a designated hazard area (room or shelf) where it can be placed with compatible wastes. ESF personnel assess what type of hazard and thus how to transport and store the material upon pick up using the written information on the waste tag and their knowledge and experience about the materials used in that setting.

Personal Safety. Areas within the ESF are designated as requiring a specific level of personal protective equipment for any personnel in that area. In addition, personnel are made aware of any ongoing working conditions at the facility, this includes notification of pouring activities and lock out/ tag out when maintenance work is being done.

Future Needs / Challenges

A computerized system for scanning barcodes on WasteTags, logging waste chemicals into the ESF, facilitating administrative requirements associated with packing into “labpacks”, generating labpack container inventory sheets and obtaining shipping approval from disposal sites is needed.

Space Requirements

The space utilized for managing chemical hazardous waste is divided into four types: temporary accumulation in the “cells”, labpacking, moving chemical waste containers around on the dock, and vehicle loading and unloading. The “cells” and labpack areas are adequate for those two functions, but both the dock and vehicle loading/unloading areas become very congested, especially when large volumes of waste must be accommodated. The dock especially was not designed for efficient movement of materials- for example forklift movement is nearly impossible. Redesign including additional dock space is needed.

Chemical hazardous waste

Background

(Regulatory driver: 22 CCR 66262.20 thru 66262.45) Chemical hazardous waste regulations include a wide range of transportation, management, recordkeeping, and reporting requirements for chemical waste. State and federal law requires that each shipment of hazardous chemical waste be documented using the hazardous waste manifest. These manifests must be carefully prepared and must include a wide variety of regulatory information. Stanford University must track each waste shipment to its ultimate disposal site.

Key Activities

The majority of chemical wastes received at the Environmental Safety Facility are materials that have been generated in very small amounts and which are extremely variable in composition. Such wastes are typically not capable, due to chemical incompatibilities, of being combined with other waste to be recycled. Therefore, they must be repackaged and sent off-site for treatment or disposal. Other wastes such as facilities generated wastes are typically collected in drums by the generator, and those drums are managed without repackaging. Chemical waste containers are stored at ESF until they can be prepared for shipment to permitted, off-site, recycling, treatment, or disposal facilities.

Lab Packing

CWP personnel pack individual containers of chemical waste into shipping containers with other containers holding similar chemical wastes. This method of packaging wastes is commonly referred to as a “lab pack”. The outer container (drum) for a lab pack is typically made of steel, plastic, or fiber material, which has been constructed in accordance with U.S. Department of Transportation specifications.

Data Entry

As containers of chemicals are packed into a drum, CWP personnel enter data into the on-line waste management system and prepare an inventory sheet including detailed information about the chemical constituents and hazards of each material contained in each inner bottle, vial or can. These inventory sheets must be submitted to treatment or disposal sites for approval prior to shipment. These sites carefully review the inventories to determine if their hazardous waste facility permit allows them to handle each waste material. When a site accepts a drum, a copy of that drum's inventory must accompany the waste shipment to serve as a reference in the event of a spill or release.

Shipping Documents

Manifests are prepared using the computerized manifest printing and tracking program which has saved 15-20 hours per week in manifest typing and revision time, ensuring more accurate manifests and more accurate manifest files. To print a waste manifest, a manifest number is entered and then the names of the generator, transporter and disposal



STANFORD UNIVERSITY

facility are chosen from list pop-ups. The computer program uses this information to determine the proper state manifest form, manifest document number, USEPA ID numbers and other address information. Boxes are provided for additional descriptions and special handling information. Completing the drum weight and EPA codes are the final bits of required data. Once all information is entered, the blank manifest form is placed in the printer and all information is printed directly to the form.

Disposal Issues

Gas cylinders, water-reactive/pyrophoric chemicals, and peroxide forming materials are three of the most difficult types of waste to dispose of. Whenever possible, CWP has instructed that cylinders should be returned to the manufacturer or distributor. CWP has provided guidance to generators to contact the CWP if they encounter deteriorated or out-of-date containers of water reactive, pyrophoric, or shock sensitive chemicals, including a list of these materials. EHS has established time limits from the date of the first opening of the original container as guidelines for testing or discarding these compounds. Evaluation by a qualified chemist regarding container integrity, stability of the chemical, and presence of peroxides, may be required prior to removing these materials from a laboratory. In some cases, high-hazard chemicals are left in the laboratory until a contractor can conduct the removal. Disposal of these wastes require chemist evaluation and/or certification, or may require a specialized contractor who is equipped to address these high hazard wastes.

Space Requirements

The facilities and space available to the HWP must be designed to accommodate periodic influx of large quantities of waste resulting from lab renovations, lab moves, and novel research projects. The amount of additional floor space required for these periodic waste surges has historically ranged from 100 to 250 square feet. When the waste is collected in drums, outdoor space (with secondary containment) is suitable. If in small individual containers like the waste generated from lab cleanouts and moves, indoor space is needed.

Future Needs / Challenges

Air Emissions

A system for controlling the air emissions from the liquid waste pouring and bulking operation is needed to ensure minimum impact to the environment. While not required by regulation, controlling these emissions would contribute to our sustainability programs.

Space Requirements

The space utilized for managing chemical hazardous waste is divided into four types: temporary accumulation in the “cells”, labpacking, moving chemical waste containers around on the dock, and vehicle loading and unloading. The “cells” and labpack areas are adequate for those two functions, but both the dock and vehicle loading/unloading areas become very congested, especially when large volumes of waste must be accommodated. The dock especially was not designed for efficient movement of materials- for example forklift movement is nearly impossible. Redesign including additional dock space is needed.

Surplus chemicals

Background

(Regulatory driver: 22 CCR 66260.10, 22 CCR 66261.2(d)) Environmental Protection Programs (EPP) has established the surplus chemical program as a way to reduce chemical purchase and waste disposal costs as well as contribute to Stanford’s sustainability programs. While there are no regulations requiring establishment of a surplus chemical program, “surplus materials” are defined in the regulations, and regulatory restrictions do exist such as requirements to prevent speculative accumulation.

Key Activities

EPP has established a user friendly web based method for both donating unneeded chemicals to the program as well as requesting that EPP deliver the chemicals to the user. Chemicals accepted into the program are inventoried using ChemTracker. Usable chemicals are stored in a special shed that is equipped with lighting, fire suppression, and secondary containment. The footprint of the shed is 325 square feet.

Future Needs / Challenges

The storage shed does not have any climate control. As a result, the fluctuations in humidity and temperature shorten the

useful life of chemicals stored in the shed, necessitating periodic disposal of chemicals that may have otherwise been reused.

Radioactive waste

Background

(Regulatory driver: 10 CFR 20.2001, Stanford’s Radioactive Material License) Radioactive hazardous wastes are managed in accordance with Nuclear Regulatory Commission license requirements and the conditions of the ESF Use Permit. Stanford’s Radioactive Material License allows for “Storage for Decay” of wastes containing short lived radioisotopes such as 32P.

Key Activities

Laboratories

Projects generating radioactive wastes segregate their materials into solid, liquid and dry wastes, and animal carcasses. Within each category, they are further segregated by the contained isotopes. The generator submits a pickup request, including description of the physical form of the waste and the isotopic inventory.

Pickups

The Radioactive Waste Program (RWP) organizes pickup requests by location and weekly completes a round of pickups. The pickup vehicle must be surveyed prior to and at the conclusion of the round to ascertain if any radiological contamination is present.

Iodine Therapy support

Radioactive Iodine is given to patients as a treatment for various medical conditions. After being administered the patient as well as their body fluids will show an activity level above background. The waste program prepares rooms within the hospitals (Main, LPCH. VA) by covering all surfaces likely to come in contact with body fluids with the purpose of trapping and then appropriately disposing of such. In addition the radioactive tech will stand by while doctors are administering the dose verifying monitoring readings and assisting with prescribing the amount of time personnel can work in the room or at bed side. Once the patient is discharged the technician will check for any lingering activity in the room, remove all coverings, and clean until activity has reached a level



adequate to release the room to re occupancy.

Storage at ESF

After the HWP has picked up radioactive wastes from the labs, they are temporarily stored in the radioactive waste storage warehouse located at ESF. The footprint of this facility is 5,570 sqft. Radioactive hazardous wastes are logged into the storage facility tracking system when received and assigned to specific storage locations. The majority of the wastes are stored on shelves in the warehouse; animal carcasses and nuclear medicine patient wastes are stored in a specially constructed freezer. The computer system tracks the storage time and total activity in storage. Hold for Decay - Radioactive wastes with half-lives of less than 90 days such as phosphorus-32 (32P) and sulphur-35 (35S) are stored until their activity has decayed to a level that they can be managed as non-radioactive waste. Once these materials have decayed below regulatory limits, they managed as non-radioactive waste.

Radioactive Waste Disposal

Decayed wastes are shipped off-site for incineration at an approved medical waste incinerator. Long half-life radioactive wastes such as tritium (3H) and carbon-14 (14C) are packaged for shipment to an off-site thermal treatment facility for volume reduction and the residuals are land filled at an approved radioactive waste disposal facility. Scintillation cocktail fluids containing 3H and 14C below regulated limits may be disposed as non-radioactive waste. These materials are handled in the same way as all other chemical hazardous wastes. Scintillation cocktail fluids containing radioisotopes other than 3H and 14C are regulated as mixed chemical and radioactive hazardous waste in California, due to the aquatic toxicity and flammability of the fluids used.

Mixed Radioactive and Chemical Waste

Mixed wastes must be disposed at one of the very few permitted facilities in the United States that can accept mixed wastes. Each mixed waste must be exhaustively reviewed by the facility to assure that treatment and disposal are performed in accordance with their NRC license and their EPA permit. The approval process may take more than a month, and disposal costs may total thousands of dollars per drum. EPP and Health Physics jointly developed a mixed

waste generation policy that is referenced in the Radiation Safety Manual. The policy requires any researcher who contemplates a procedure that will result in mixed waste to review their protocol and attempt to eliminate the generation of a mixed waste. If the researcher thinks that the mixed waste is unavoidable, they must present their protocol Health Physics for approval. The approval process includes investigation of disposal options and costs. EPP and Health Physics have also worked jointly to develop protocols for in lab treatment of the chemical portion of selected repetitive mixed waste and in lab decay of short half-life mixed wastes. These protocols allow transformation of those "routine" mixed wastes into straight radioactive or chemical hazardous waste which reduces both the cost and long term liability associated with managing those wastes.

The RWP conducts all these activities in a specially designed warehouse of 5,570 square feet. The facility is approximately 25 feet high, allowing for stacked storage. It contains a freezer for storage of animal and patient wastes, as well as a dedicated area for storage and management of mixed waste.

Future Needs / Challenges

The program is in excellent condition, with no additional future needs identified.

Universal waste

Background

(Regulatory driver: 22CCR 66273) State and Federal regulations prohibit the improper disposal of a category of hazardous wastes known as universal wastes. These wastes are termed "Universal" because their point of generation is not limited to a typical hazardous waste generation activity such as a lab environment. Examples of these wastes include, but are not limited to: batteries, fluorescent lamps, and small electronic devices. Large electronic devices are managed by the Stanford Property management Office through Surplus Sales.

Key Activities

Since the generation points for these types of wastes are not limited to shops or laboratories, a more extensive collection methodology had to be created. EPP has

set up approximately 150 dropoff locations on campus for convenient disposal of batteries. This approach allows an employee not directly tied to a laboratory to conveniently dispose of his/her batteries without being required to complete a hazardous waste pickup request. Similarly, there are over 100 dropoff locations on campus for disposal of small electronics (e.g. pdas, cell phones, keyboards, circuit boards, etc.). By providing convenient access to consolidation buckets, generators are less likely to improperly dispose of their respective universal wastes.

Pickups of Universal Waste - On a monthly basis, technicians service each location. The batteries are consolidated and transported to the Environmental Safety Facility for segregation prior to disposal.

Packaging of Batteries - Per DOT regulations, certain types of batteries have to be segregated and prepared for shipment. For instance, lithium and lithium-ion batteries are required to be shipped separately. DOT regulations require button cell batteries to be individually taped or otherwise packaged so that terminals on a battery do not come into contact with terminals from adjacent batteries. Similarly, terminals must be taped on all laptop and "flashlight" type lithium batteries. There are similar requirements for nickel-cadmium batteries. As a result, an extensive segregation process divides batteries into a few broad categories, the batteries are prepared for shipment, shipment paperwork is generated and the batteries are shipped for recycling.

Electronic Waste - HWP collects small electronics from the consolidation points and transports to the ESF, where it is separated into one of two categories, reusable or recyclable. If the item is deemed reusable, it is rerouted to the Surplus Property Store on campus for reuse or resale. If the item is not deemed reusable, it is prepared for waste disposal.

Space Requirements - The current battery and electronic scrap processing area is approximately 15' X 15'. The interim staging area for universal wastes awaiting shipment is approximately 20' X 20'. Both of these areas are currently housed in the ESF Annex where radiological waste is also stored. Economies of scale in terms of shipping costs are achieved with a staging area of this size.



Future Needs / Challenges

225 sqft is of uncovered space currently used for unloading and staging Universal Waste. This area should be protected from rainfall to prevent runoff of contaminated water.

Long-term liability

Background

(Regulatory driver: CERCLA Section 104, SCC B11-317(m)) Pursuant to hazardous waste and site cleanup laws, Stanford University owns the hazardous waste it generates forever. The fact of shipping the waste to a facility for treatment or disposal does not in any way eliminate future liability if the waste is mishandled and eventually harms people, animals, or the environment. Pursuant to the Toxic Gas Ordinance, Stanford is required to maintain an emergency response capability. Additionally, we have implemented a 24/7 chemical spill response capability to provide a service to labs in cleaning up small non-emergency spills, as well as respond to emergency releases.

Key Activities

The Hazardous Waste Program conducts a waste treatment, storage and disposal facility review program in order to assist in selecting contractors and sites that are well run and financially stable. The review significantly limits the number of facilities used by Stanford University and provides assurances that the facilities used will remain in operation. This review and approval process is accomplished through the use of standardized audits provided by outside review groups, assessment of vendor provided audit information, site visits, and general literature review for environmental issues at these facilities. HWP personnel have been trained to comply with California OES and OSHA requirements for hazardous material incident responders and hazardous waste operations. This training allows Stanford to respond to on-site spills and perform short-term mitigation. This response minimizes the extent of these releases, and reduces the potential for long term liability due to soil or groundwater impacts.

Future Needs / Challenges

With the continued elimination of disposal options, we need to conduct in-depth reviews of radioactive waste disposal sites,

both landfill and incineration. We need to develop the "Hazard Assessment and Reconnaissance Team" to provide quick assessment of the impacts to labs from hazardous materials releases during an earthquake. This group would be recruited from building occupants in the areas most potentially impacted. In addition, we need to train EH&S staff to provide support to the HazMat team, not for actually performing building entry, but to provide vital support to the entry teams during disasters.

Waste minimization

Background

(Regulatory driver: Cal H&SC 25244) California law and regulation was recently revised to exempt research laboratories from requirements to prepare a waste minimization plan and report. Academic teaching labs and facilities operations are still regulated. Current enforcement flexibility regarding on-site management of mixed waste requires the institution to have a waste minimization program for mixed waste.

Key Activities

To reduce the total expenditure on hazardous chemical waste management, EH&S encourages efforts to minimize the quantity and toxicity of hazardous chemical wastes generated. In September 1991, EH&S developed a plan for reducing the amount of these wastes generated at Stanford. The plan includes several options for reducing both the amount of chemicals actually used and for minimizing the total volume of chemical waste generated throughout the Stanford community. In 1999 this plan was revised in accordance with regulatory changes that exempted research lab waste from the plan.

Reducing the Amount and Toxicity of Hazardous Materials Used

This represents the first and most important means of reducing the hazardous waste that must be disposed of or managed. Research laboratories and working groups have been encouraged to examine their chemical purchasing practices and systems and their chemical usage and workplace activities to determine where source reduction can be implemented. To assist in waste minimization and recycling efforts for spent photo fixer, bleach-fix, stabilizers

containing silver, developer, and functionally similar solutions, the HWP have contracted with off-site recycling facilities for silver reclamation. Five-gallon containers are provided by CWP for these wastes..

Bulking of Non-halogenated Waste Solvents and Waste Oils

These wastes are consolidated into 55 gallon drums for off-site recycling as paint thinner or for use as supplemental fuels in industrial processes..

Solvent Recycling

The HWP is currently recycling methanol solvent waste streams at ESF for reuse by campus generators. Waste is received from campus clients in the Department of Chemistry, distilled, analyzed and returned to the labs.

HWP has promoted the recycling feature of the Stanford Chemical Inventory System (SCIMS) for managing, trading, and tracking reagents for reuse within the labs. This database is available to researchers and act as an electronic bulletin board for swapping of reagents with a known history and condition. In addition, HWP has established a central storage area for unused chemicals that researchers want removed from their labs. These materials are entered into the HWP Chemical Reuse inventory that is available to all campus SCIMS users. These chemicals are provided to researchers free of charge upon request.

Finally, HWP facilitates chemical reuse within the Department of Chemistry during large cleanup projects by assisting the labs to find researchers who may be interested in taking these chemicals rather than disposing them as waste.

Future Needs / Challenges

Waste minimization reports have resulted in identification of cooling tower wastes as the largest volume waste subject to waste minimization. We continue to work with Stanford Utilities to determine if and how the generation rate of this waste can be reduced. The chemical redistribution program is limited because the storage facility here at ESF does not have any climate control provisions. The temperature and humidity variations over the course of a year cause deterioration of reagents and reduce the likelihood that



researchers will want to use them. A study of the various available measures (insulation, heating, cooling, humidity control) to increase the stability of materials in storage is needed. With this data we could evaluate whether any additional measures would enhance the program.

Regulatory review and advocacy

Background

In recent years, state, local and federal legislative and regulatory bodies have enacted many new requirements affecting Universities and research. The HWP staff has been very active with local business groups and advocacy organizations in making comments regarding proposed requirements in the areas of radioactive and chemical waste. One example includes California legislation requiring that all materials with any measurable activity above background, regardless of the degree of potential harm, be disposed at a licensed disposal site. Our efforts, along with those of biotechnology research companies effectively halted this proposal in 2002. Another example are the Federal Regulations; which are currently allowing on-site accumulation of mixed radioactive and chemical waste without the stringent restrictions of hazardous waste regulations

as long as it is accumulated in accordance with a Radioactive Materials License. Our comments supported EPA in this proposal, and it was adopted in 11/01.

Key Activities

Regular monitoring of various electronic bulletin boards and lists, and review of published legislative and regulatory proposals provides the input regarding issues that may potentially be of concern. Active membership in various professional and business groups provides both an opportunity for sharing concerns with affected entities, and a very effective vehicle for expressing concerns either verbally or in writing to legislators and regulatory agencies.

Early in the process we usually attend a workshop or hearing presented by the proposing agency or legislator. This hearing provides important perspective in developing our initial comments. Once HWP staff has developed a preliminary written comment, we work closely with affected Stanford community to obtain their suggestions and concerns. Following internal vetting, the comments are reviewed by Government Relations, and then forwarded to colleagues at other institutions and to the groups that we belong to for additional input. If possible, we meet directly with the interested legislators or with regulatory

representatives, or attend follow-up workshops. Final comments are then provided to the legislator or regulatory agency.

Conclusion

The Hazardous Waste Program has gone through significant revision preceding and following the negotiations and settlement with the State of California Department of Toxic Substances Control (DTSC) in 1994. These new and enhanced programs have been designed and implemented to ensure that hazardous waste is managed safely and in compliance with regulatory requirements in the labs, shops, and classrooms as well as at the ESF.

The current Program consistently achieves the fundamental goals of the Department and University as a whole. The waste programs at Stanford are recognized as exemplary and highly efficient in the private sector and by other academic institutions. Regulating agencies consistently find the operation to be wholly in compliance with all applicable regulations. The Department's waste programs continually and professionally promote the protection of human health and the environment while seamlessly supporting the research activities of Stanford University.

Air Emissions

Source Permitting

Background

(Regulatory Driver: BAAQMD, Rule 2-1-316) The Environmental Protection Agency regulates air emissions and has delegated most programs to the local agency, the Bay Area Air Quality Management District (BAAQMD). The BAAQMD regulates air emissions from stationary sources. Permits are required for all sources unless they are exempt. Many research operations are exempt from the requirement to obtain an air permit. Sections 2-1-113 provides exemptions for buildings devoted to classroom experimentation; research buildings are exempt if they contain less than 25,000 sq.ft of lab space, or less than 50 fume hoods. If a building cannot qualify for an exemption pursuant to 2-1-113, section

126.2 provides an additional exemption for "bench scale laboratory equipment". In order to apply this exemption, a facility must pass an Air Emissions Human Health Risk Assessment. Operations that support research activities, such as emergency power generation, are not covered by these permit exemptions. Sources of emissions may be covered by other regulations in addition to the requirement to obtain a permit and emission limitations may be applicable.

Key Activities

EPP maintains the list of the sources that have been evaluated and a file of the associated operating restrictions. In addition, all new buildings and are evaluated to determine if they are exempt from BAAQMD permit requirements. Emergency Generators are permitted prior

to installation. The required Health Risk Assessments are discussed below.

Future Needs / Challenges

The loss of the ½ time Environmental Engineer position has required doubling of the effort of other Environmental Protection Program (EPP) staff. Reinstatement of this position would provide critical resources for managing these issues.

Source Compliance

Background

(Regulatory Driver: BAAQMD, Rule 2-1-316) Regulatory operating requirements apply to both permitted and exempt units. Stanford operates over 100 permitted Diesel Emergency Generators, and fuel transfer equipment at the fleet fueling garage. These sources require annual



STANFORD UNIVERSITY

permit renewal and must operate under conditions.

Key Activities

Maintaining compliance with either Permits or exemptions requires EPP to explain requirements to the “Operators” of the emission source and maintain close communication as questions arise. The annual permit renewal process also provides an opportunity for this interaction.

Emergency Generators

EPP provides a copy of each permit when issued by BAAQMD along with and instructions to the “Operator” either LBRE or School of Medicine Maintenance staff, regarding the compliance obligations. EPP has developed and distributed compliance summaries for these operators.

Laboratory Exemptions

Training of fume hood “Operators” is also provided by EPP as a way to maintain the permitting exemption. The fume hood operation requirements are included as a part of the chemical safety training for researchers. Signs are posted at fume hoods by the Heating, Ventilation and Cooling department as part of the fume hood certification program.

Assessment of Future Needs

Reinstatement of the ½ time Environmental Engineer position would provide critical resources for managing these issues.

Risk Assessment

Background

(Regulatory Drivers: BAAQMD Regulation 2, Rule 5, California Air Resources Control Board, Diesel Air Toxics Control Measure) The regulation of toxic air emissions is covered by several overlapping sets of requirements. The BAAQMD has implemented the Air Toxics Hot Spots Act, and requires risk assessments for emissions greater than threshold amounts. Diesel particulate

emissions are of great concern. The discharge of toxic air emissions is quantified and evaluated to determine if there is any significant adverse effect to human health. The emissions are modeled and risk factors used to calculate the impacts.

Key Activities

As a part of the approval for new construction projects, environmental issues must be addressed and BAAQMD and the California Air Resources Board (CARB) required that the risks of air emissions from proposed projects be quantified.

Laboratory Fume Hood Emissions

EPP has conducted several reviews, notably in the early 90’s and since 2001 in order to determine if there was an unacceptable risk due to emissions of air toxic compounds. This data was used for several purposes including the satisfaction of the requirements of the Air Toxics Hot Spots Act. As a part of the preconstruction review EPP estimates emissions or specific air toxic compounds from planned buildings as a part of the evaluation for environmental impacts. Recently, emissions from the following buildings have been assessed: Lokey ChemBio, 7/01; Clark, 12/02; and currently under evaluation Bio/Chem Engineering.

Emergency Generators

Pursuant the BAAQMD Air Toxics requirements, and the CARB requirements, all the emissions from each proposed Diesel Emergency Generator must be evaluated to determine if the pose an acceptable human health risk. The risk is driven by the diesel particulate emissions. EPP provides the data to BAAQMD which is used in this evaluation. Permit restrictions or emission control devices have been required in the past, and this will continue.

Site Wide Cumulative Health Risk Assessment

EPP is managing a project to evaluate diesel particulate emissions from all 110

emergency generators on campus. The work product will be an interactive graphical representation of the main campus, buildings, generators and a grid of potential receptor locations. The output at a receptor location will display the cumulative exposure and associated potential health risk, as well as the generators contributing the bulk of the exposure at the location. This tool will be used to determine which, if any, generators to retrofit or replace to reduce risks.

Title V Permit

EPP reviewed the total emissions of hazardous and conventional air pollutants to determine if a permit was required under Title V of the Clean Air Act Amendments of 1990. Under current operations and regulations, no Title V permit is required. If Stanford assumes the operation of the Co-Generation plant, or if significant emissions result from any new power facility under Stanford’s permits, we may become a Title V facility.

Environmental Impact Analysis

The Planning Department is responsible for the environmental impact analysis requirements, and EPP supports them in this effort by developing estimates of emissions from laboratory activities and reviewing potential impacts.

Future Needs / Challenges

The air toxics risk evaluations have been of great value to Stanford and the research community nationwide. The studies have established credibility, helped to negotiate exemptions, and are being used to argue that research and development does not need to be listed as a source category by the EPA. The very early emission estimates and risk assessments have not been updated since they were written and this information is becoming dated. Because air toxics continue to be an active area for regulatory development, it would be prudent to update selected historical air toxics risk assessment studies.

Wastewater Discharge Management and Compliance

Background

(Regulatory Driver: Palo Alto Ordinance # 16.09 and Permit # 03134) Although the Environmental Quality Manager in Utilities has oversight of wastewater

requirements, EPP provides support when laboratories are involved. EPP works closely with the Safety and Compliance Assistance program to ensure compliance with both the Ordinance and the Permit.

This helps streamline the communication of chemical management requirements to laboratories. The Environmental Quality Manager’s oversight responsibility involves conveying regulatory requirements,



STANFORD UNIVERSITY

interpreting regulatory requirements, and interacting with the relevant agency.

Key Activities

EPP involvement makes enables clearer and more consistent communication to the laboratories due to our activities in waste

management and building renovation and construction review.

Hazardous Material Response. If a hazardous material release threatens to or has impacted a storm drain, creek, or the sewer system, EPP manages the response and required notification to agencies.

Future Needs / Challenges

Continue to work with City of Palo Alto on revisions to the Wastewater Permit to modify monitoring requirements and avoid non-compliance caused by existing improper monitoring requirements.

Hazardous Material Spill Prevention and Response

Background

(Regulatory Driver: 22 CCR 66264.50 thru 265.66, SCC Toxic Gas Ordinance) As a facility using and storing hazardous materials, and generating hazardous waste, Stanford University is required by OSHA, EPA, the County of Santa Clara, the Department of Toxic Substances Control, and the Regional Water Quality Control Board to prepare for hazardous material releases. This preparation includes development of spill prevention and response plans, installing and managing spill mitigation facilities such as secondary containment, and providing spill response capability. State law requires specific certified training for each responder including 24 hours of initial training, an annual eight-hour refresher, and training on the use of Self Contained Breathing Apparatus, as well as health evaluation and monitoring.

Key Activities

EPP has developed and been a major contributor to several response plans including the hazardous waste Contingency Plan, the Toxic Gas Response Plan, the California-Accidental Release Plan for the Central Energy Facility Ice Plant, and the Spill Prevention Control and Countermeasures (SPCC) Plan. Each of these plans impacts different constituencies at the University such as lab personnel, Environmental Safety Facility staff, facilities operations, utilities, housing and dining, and athletics. This wide range of affected personnel requires EPP to work closely with all levels of University personnel to make sure that the plans are useful and that the potential for spills is

reduced and response is timely and effective.

Hazardous Material Response Team

EPP provides 24 hour a day, seven day a week response capability for moderate releases that labs or shops cannot handle themselves, or if the person spilling the material or discovering the release needs assistance or advice. During working hours, the entire eight-person EPP staff is available to respond within 30 minutes. At night, or on weekends/holidays, two members of the team are available via pager through the Stanford Operator at all times, and they can call for additional resources from the staff if needed. Since most members of the staff live very distant, response is greater on nights and weekends. For serious or health threatening releases, or if injuries or fires are involved, Stanford University staff and students are instructed to call 911 for Palo Alto Fire Department (PAFD) response. EPP staff trains jointly with PAFD and we work closely together to ensure effective response. In case of Fire Department response, EPP responders serve as liaison to the outside responders, and have made joint entries into areas where releases have occurred.

Training

Since trainers must be state-certified, Stanford uses outside professional responders to provide the initial training and the required annual refresher. EPP works closely with the training provider to tailor the class to the unique needs of an academic institution and provide different topics each year. Past training has included Biological incident response, using hand

held monitoring equipment, toxic gas response, and specialized training on leaking pipes and containers.

Reporting Releases

If reporting to regulatory agencies is required, EPP is responsible for collecting and documenting all pertinent facts and providing the verbal or written reports. Regardless of reporting requirements, all requests and responses are documented on standard forms, and these reports are kept in our files. If the incident review indicates a systematic failure, EPP works with affected parties to correct any deficiencies or recommends procedural and/or equipment enhancements. EPP also provides spill prevention and response training to labs, shops and other affected personnel.

Future Needs / Challenges

Due to the very limited resources available for response, EH&S plans to expand the available on-site response capability through development of the Hazard Assistance and Reconnaissance Team (HART). This team will be composed of University volunteers who are interested in being able to make quick assessments in their immediate area of the degree of HazMat damage following a major emergency such as an earthquake. These assessments will be used by the University Emergency Operations Center (EOC) to prioritize the use of existing resources for further action and to enable reopening of buildings after a major event. This is a critical need given the very limited resources of the EPP staff for responding these cases.

Plan Reviews

Background

New Construction and Renovation Review

Environmental and hazardous materials issues need to be addressed as a part of construction activities in order to ensure regulatory compliance, eliminate delays during construction, maximize



hazardous materials safety after the building is occupied, and minimize future impacts to both the occupants of the new facility and to the environment. The purpose of this program element is to ensure that a newly constructed facility is designed to optimize its flexibility and safety within the regulatory framework. Research facilities often require unique features and future flexibility not usually anticipated by prescriptive codes and regulations. This area coincides with other EH&S programs and works closely with them in the review process. In particular, Environmental Management Program addresses air emissions, storage facility design, emergency response features, and hazardous transportation issues. This program element is driven by Stanford's County of Santa Clara Use Permit conditions, California Building and Fire Codes and Bay Area Air Quality Management District Rules.

Key Activities

The process includes being notified by projects or the University Fire Marshal of a project involving hazardous materials or having other potential environmental impacts, identifying issues within the project, evaluating their regulatory impact and options for mitigating them, and communicating findings to the project proponents.

Future Needs / Challenges

Future activities and focus for this program element include: Steps to better identify projects that have environmental and hazardous materials issues could be developed. Information about future projects can be obtained from the Fire Safety group or the planning department; and Continue to work closely with owners representatives and construction project managers.

Sustainability

Background

(Regulatory Driver: Stanford Policy)

This program element is driven by Stanford Policy and is developed and implemented in close partnership with the University Sustainability Program managed by LBRE.

Key Elements

Working closely with the University Sustainability working group and committees to help propel University wide programs takes considerable effort. EPP has been involved in the bottle water replacement initiative, and more recently the pilot program for composting food waste from the EH&S kitchen.

Future Needs / Challenges

Environmental management systems are emerging as a new standard in the environmental field. Elements of such systems are known by many different names: strategic environmental management (SEM), total quality environmental management (TQEM), and environmental management systems (EMS). Although an EMS is often used to attain ISO 14000 certification, Stanford does not need to take the process to that extreme. An EMS is a framework within which to manage responsible fiscal and environmental stewardship. Stanford can choose to implement only those portions of an EMS that benefit the university. Appendix I provides an outline of an EMS which may be appropriate for Stanford.

Toxic Substances Control Act

Background

(Regulatory Driver: 15 USC 2604(h); 40CFR 723.3)

The Toxic Substances Control Act (TSCA), administered by Environmental Protection Act (EPA), is intended to evaluate and address the human health and environmental risks of chemical substances prior to them entering into commerce. Indications are that compliance with TSCA requirements in research laboratories has received increased scrutiny by EPA in some regions.

Key Elements

This program is in the planning stage.

Future Needs / Challenges

To address any regulatory risk OH&S will be working closely with the Environmental Programs to develop the guidance and resources to assist labs with TSCA requirements.

Conclusion

The Environmental Management function of the EPP has matured over the past several years, particularly with respect to permitting and evaluating sources of air emissions. All sources requiring air permits are in compliance with permit conditions. Continued attention to emissions of air toxic chemicals has significantly increased our knowledge of potential health effects related to emissions from Stanford's operations, both laboratory and "conventional" sources like emergency generators.



Historical Activities (Projects)

Background

Stanford has operated on the campus for over 100 years which has resulted in several areas that have required environmental projects. These projects may be driven by historical releases, wells requiring closure, or decommissioning of waste management equipment such as the incinerator.

Key Activities

Potential soil and ground water impacts are investigated, a risk evaluation conducted and the contamination is addressed. This program element involves extensive oversight by regulatory agencies and the work associated with the “paperwork” often exceeds the effort placed on actually addressing residual contaminants. This program element is driven by the State of California Water Code Section 13340. This program element is differentiated from the Facilities Closure activity because a significant portion of the effort is expended to collect necessary information about the historical unit. The Closures activity addresses units that are currently operating and for which there is usually adequate information available. Depending on the type of site and its history, remediation activities may be covered by regulation or may not be regulated at all. Remediation activities may be regulated under the Department of Toxic Substances Control (RCRA, state hazardous waste law), the State Water Resources Control Board (through the Regional Water Quality Control Board and the Santa Clara Valley Water District), the County of Santa Clara and/or the city of Palo Alto. These agencies have overlapping jurisdictions and a lead agency must be identified. Often, determining the appropriate regulatory agency is a time-consuming first step. In general, once the relevant regulatory agency for remediation activities is determined, a closure plan is submitted to the agency, this plan is approved by the agency and then implemented by Stanford. A post-closure report is sent to the relevant agency and formal approval is granted by the agency. The post-closure report may recommend future actions, such as ground water monitoring. Specialized expertise is necessary and so consultants are often used. Significant progress was made in this area in the 1980s when many underground tanks were located and removed from service. The effort to address historical sites continued through the 1990s to address more difficult sites. In 1994 Stanford conducted an initial RCRA Facility Assessment that considered all possible contaminated sites on campus throughout the whole of Stanford’s history. This assessment revealed a few more sites to address. Although thorough work has been conducted, the university has to be ready to address as yet unknown sites. When there is ground water contamination, or significant potential for ground water contamination, the project is handled by the Environmental Quality Manager in Utilities. If it is soil or RCRA-related, the Environmental Management Program may

manage the project. The management of other projects that do not clearly fit into this scheme is negotiated between the two departments.

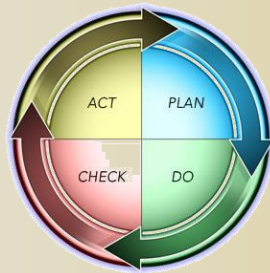
SOIL AND GROUND WATER PROJECTS

Sites that have been completely addressed:

1. Solvent waste tank at CIS
2. Underground acid neutralization tank at Terman
3. Former fleet fueling tanks (4 underground tanks)
4. Former garage waste oil tanks (2 underground tanks)
5. Public safety fuel tanks (2 underground tanks)
6. Old steam plant, 02-520 (6 underground tanks)
7. Plating shop – soil at site where drums were historically stored
8. Quarry open burning / open detonation unit
9. Tanks at HTGL for ethanol, fuel and diesel (4 underground tanks)
10. Underground tank at the Knoll
11. Hansen labs – 2 underground transformer tanks
12. Hansen labs – 3 underground fuel tanks
13. Ginzton – 1 underground fuel tank (closed in place)
14. CEF – 4 underground fuel tanks
15. Golf - 1 underground fuel tank
16. Athletics (05-800) – 1 underground fuel tank
17. Petersen – 1 underground fuel tank
18. Hoover hospital – 3 underground fuel tanks
19. CIS waste solvent tank
20. Old Children’s hospital – 2 underground fuel tanks
21. Mitchell tiered permit units (2)
22. McCullough tiered permit unit
23. Carnegie Institute – 1 underground fuel tank
24. RCRA corrective action (review of whole campus)
25. Quarry landfill
26. Gas station at Galvez and El Camino Real, (unknown, possibly 4 underground tanks)
27. Old steam plant, 08-400 (1 underground tank)
28. Buck Estate Soil
29. Groundwater Monitoring Wells at Moffet NAS
30. EH&S Incinerator
31. Final removal of Ginzton UST
32. Beckman Emergency Generator Fuel Tank Release (final report pending)
33. Casmalia Superfund Site

Future Needs / Challenges

Due to the nature of this program element, it is nearly impossible to predict which projects may require attention. Currently, two projects are underway. **Bay Area Drum Superfund Site** – EPP has responded to EPA with a voluminous amount of data as requested. We expect that EPA will assess Stanford a di minimus amount in the future to settle this case. **Site 515 Well closure** – EPP has bid the project, reviewed the bids and will award the project shortly. The project should be completed by early 2012.



Outline of Environmental Management System

Goal

The goal of this program element is to integrate environmental actions into regular, existing business strategies where they make financial sense.

The steps that are proposed for the EMS are:

1. Identify activities that have potential environmental impacts;
2. Catalog initiatives and practices already implemented that address these impacts;
3. Analyze existing initiatives and practices from step 2, focusing on realized benefits: identify examples of cost reduction, improved business efficiency, satisfied operational needs that also protect or enhance the environment;
4. Evaluate the activities with potential environmental impacts from step 1 to determine if the approaches and strategies identified from steps 2 and 3 could be applied to achieve cost reduction, improved business efficiency, satisfying operational needs, while protecting or enhancing the environment;
5. Determine if existing initiatives and practices from step 2 could be extended or enhanced;
6. Document and communicate the value of the University's efforts.

The EMS does not need to include regulatory compliance, although it is an aspect that can be considered. Many business entities have implemented an EMS and have realized both environmental and financial gain. Other universities have undertaken to establish an environmental management system and their input would be sought. There are no regulatory requirements directly met through this element, although such activities help to undercut the need for future regulations. The driver for this program element is not regulatory in nature but is designed to reduce operating costs while benefiting the environment. Future activities and focus for this program element include: Determining the institutional need for the program; and Creating the program if it is needed.

Public Relations

The benefits of developing and implementing an EMS include improving the image of Stanford with the local community and among other academic institutions nationwide. These results will only be realized if there is a concerted effort to collect and publicize this information. Even if no new activities derive from the environmental management system, the university would benefit from cataloging the activities that have already been implemented. Some of the uses of this information could be to apply for awards, in community meetings held by the Government and Community Relations department, to make public information signs describing efforts on campus, to give out information to campus visitors, and in campus newspaper articles. For example, the Utilities Environmental Quality program won the 1996 Community Environmental Protection Award with the support of the labs and Environmental Health and Safety. Future activities and focus for this program element include: Determining the institutional need for the program; and Creating the program if it is needed

Resource Conservation

As a part of the EMS, identify areas where campus resources can be conserved. Environmental aspects that should be considered as a part of the resource conservation element of the EMS are: Energy conservation, Water conservation, Construction waste recycling, Use of recycled materials within new construction, Habitat enhancement, Alternative fuel vehicle fleet, Cooperative work with the BAAQMD to promote their "spare the air" campaign, and Pesticide and herbicide toxicity reduction. Some of these environmental aspects have already been addressed. The only related regulatory requirement is a state requirement that municipalities reduce solid waste disposal by the year 2000. This requirement does not directly fall on the university, although the campus will need to participate in solid waste reduction activities.



Policy & Regulations
Publications
Recordkeeping



Training and Communications

Training is a key element in all health and safety programs. Health and safety training helps people understand the specific hazards related to the processes and materials that they use, the general hazards found in their work environment, and the safety regulations, policies, programs, and available support systems. Training can be provided to meet multiple objectives including improving local safety, ensuring compliance with regulations, and changing behavioral patterns.

Supports these University Units:	Technical Services Provided	Business Drivers
<ul style="list-style-type: none"> • General Workplace Settings • Research Laboratories and Clinics • Facilities Service Operations • Construction / Renovation 	<ul style="list-style-type: none"> • Compliance Training • Three Tiers of Training • Course Delivery • Recordkeeping • Communications / Publications / Delivery of Materials 	<ul style="list-style-type: none"> • University employees • Research involving hazardous materials (bio / chem / rad) • Risk Management • Accident Investigations



Program Elements

Overview

Compliance Training	Three Tiers of Training	Course Delivery	Communications / Publications Delivery of Materials
<ol style="list-style-type: none"> 1. OSHA regulations 2. California DTSC 3. Department of Transportation 4. Radiation Safety / Nuclear Regulatory Commission 	<ol style="list-style-type: none"> 1. Tier 1: General safety 2. Tier 2: Site Specific 3. Tier 3: Hazard Specific 	<ol style="list-style-type: none"> 1. New employees 2. Faculty 3. Recordkeeping 	<ol style="list-style-type: none"> 1. Distribution of Materials 2. Stanford's IIPP Support 3. University Safety Partner Network 4. Accident follow-up system and Liaison work with Risk Management

Background

One fundamental reason for providing training is accident prevention. However, environmental health and safety training is also mandated by a host of federal and state laws and regulations impacting a wide variety of positions throughout the University. The requirement for training is clearly spelled out in the regulations, but the content of the training is not always so clear. External/regulatory forces that drive the need for training include:

Compliance Training

Occupational Safety and Health Administration (OSHA) Regulations

The Injury and Illness Prevention Program (IIPP)

The Injury and Illness Prevention Program (IIPP) regulation is mandated and enforced by the California Occupational Safety and Health Administration (CAL/OSHA). The IIPP represents the University's "umbrella" health and safety program covering all employees whether they work in offices, labs, shops, kitchens, etc. One of the requirements of the IIPP is that all employees, including temporary employees, be trained when first hired so they are familiar with general and specific hazards related to the job they must perform and how to protect themselves from being injured if exposed to any specific hazard. Employees must also be trained when a new hazard is introduced into the workplace. Failure to implement the requirements of the IIPP has been a frequently cited OSHA violation throughout California. At Stanford, OSHA has investigated reports of serious accidents and employee complaints several times since the IIPP took effect. On at least two occasions, inadequate training was cited - once under the IIPP and once under a specific General Industry Safety Order. OSHA fines have increased within recent years so future citations of this kind will be more costly.

General Industry Safety Orders

The General Industry Safety Orders in the California Code of Regulations (enforced by CAL/OSHA) contain numerous

standards with training provisions including: the use, fit, and care of respirators, emergency responders, forklift safety, confined space, machine safety, electrical safety, lockout / tagout, and hearing conservation / noise.

OSHA Regulations Covering Hazardous Materials

The Hazard Communication Standard requires a written hazard communication program and worker training to meet the employees' "right to know". This Standard applies to any workplace where employees may be exposed to hazardous substances.

The Occupational Exposure to Hazardous Chemical in Labs or "Laboratory Standard" requires a written Chemical Hygiene Plan that includes information and training elements to ensure that employees "are apprised of the hazards of chemicals presented in their work area". The Occupational Safety Group within EH&S has developed an online Chemical Hygiene Plan Toolkit to assist laboratories with developing their local Chemical Hygiene plans.

Biohazardous Materials

Those who work with biohazardous agents must be trained on safe handling and disposal (under the IIPP). Additionally, the Bloodborne Pathogen Standard requires training for all employees who could be "reasonably anticipated" to come into "bodily contact" with blood and other potentially infectious materials as a result of performing their jobs.

California Department of Toxic Substances Control

Hazardous waste training requirements are set forth in the California Code of Regulations and are enforced by the California Department of Toxic Substances Control. There are two categories for training. Waste generators who work in "Waste Accumulation Areas" can store waste for 90 days and require annual training. Waste generators who work in "Satellite Accumulation Areas" can store waste up to one year and require one-time training.



Department of Transportation (DOT) Regulations

Effective May 15, 1992, the Department of Transportation adopted new requirements for training employees who: load, unload, or handle hazardous materials; prepare hazardous materials for transportation; have responsibility for the safety of transporting hazardous materials; operate a vehicle used to transport hazardous materials; and mark, modify, recondition, repair, test, or otherwise represent containers, drums, or packaging as qualified for use in the transportation of hazardous materials. Employees employed after July 2, 1993 must be trained within 90 days after employment. Employees whose job function changes must complete training in the hazardous materials transportation aspects of their new job function within 90 days of the change. Training must be repeated at least once every two years.

Radiation Safety / Nuclear Regulatory Commission

Regulations (State of California, U.S. Nuclear Reg. Commission) stipulate that radiation workers must be kept informed of the hazards that they may encounter. All personnel must complete formal training requirements prior to handling radioactive materials at Stanford University or the VA Medical Center. All persons with neither formal training nor experience using radionuclides above a certain quantity are required to attend an eight-hour course on radiation safety. Approximately 500 individuals receive the radiation safety training each year. To comply with the regulations noted above, safety training is needed for workers throughout the campus in offices, labs, shops, kitchens, and other areas; including: Faculty/Principal Investigator/Executives, Supervisors, Staff, New employees, and Students (e.g., graduates / undergraduates / teaching assistants). Although the regulations and guidelines noted above apply specifically to Stanford employees, the University extends its safety training opportunities to include students. Some of the regulatory requirements overlap whereas in other cases they each have special regulations that apply. For instance, DOT regulations go beyond what OSHA requires.

EH&S Training Classes (recent)



THREE TIERS OF TRAINING

Health and Safety Training Policy at Stanford

The Stanford Safety Manual outlines the concept of the “Three Tiers of Training”.

Tier 1

Tier 1 will partially satisfy the requirement that employees be trained when first hired. Tier 1 is a "general university safety orientation". This training is delivered online as the General Safety and Emergency Preparedness course through STARS, EHS-4200.

Tier 2

Tier 2 training is also general in nature but is more informative and is coordinated by individual schools, departments, or EH&S. It provides general information applicable to the school/department/building. This training is accomplished in a variety of ways. Some departments opt to provide training themselves using written materials, videos, and brief safety meetings. Many schools and departments plan annual training sessions that include written materials, videos, and/or live presentation. EH&S provides materials and speakers for these sessions, upon request. Some Tier II training is available through online courses.

Tier 3

Tier 3 training should occur when an employee is first hired. This is where the most critical training takes place. Supervisors are responsible for training their workers on hazards specific to their individual workplaces and to the materials and processes that they will be using. EH&S supports supervisors in carrying out this responsibility by providing supervisor training sessions, topic-specific training sessions, written training materials (e.g., model training documents, documentation forms, ergonomics and safe lifting handouts), and videos. EH&S can also help train supervisors on how to train their workers ("train-the-trainer") and assist with development of materials, upon request. Many Tier III training elements are available through online course materials provided by EH&S but it is not a complete substitute for supervisor to employee training.

Course Delivery

Faculty

EH&S provides safety training to Executives/Faculty/PIs upon request. Faculty sessions are coordinated by individual schools/departments. The following are examples of Training Programs Offered Outside of EH&S.

New employees

School of Earth Science

The School of Earth Sciences offers a general health and safety training for all faculty, staff, and students, annually in the Fall.



Department of Chemistry

The Department of Chemistry trains all faculty, staff, and students in basic lab safety. Two levels of training are provided. First, a general training is provided. Second, training is provided that is specific to each group's research activities and needs. A safety training database is managed in the department office. Individuals are not issued keys to their laboratory until they have completed all required safety training.

Department of Biology

The Department of Biology has a lab safety training program. The Department provides general written information including a brief statement of training obligations, a list of safety reference materials, and a copy of the Department Chairperson's annual safety letter. Specialized training is also provided. When starting work, a new employee, graduate student, or post doc will meet with his/her lab coordinator to discuss safety issues relevant to the particular laboratory and agree on an appropriate training plan.

Department of Physics

The Department of Physics and several other academic departments offers a general health and safety training for all faculty, staff, and students, annually in the fall.

Building & Grounds Maintenance

BGM offers regular training. Approximately 6 times during the year, the training is provided by EH&S staff and focuses on health and safety issues.

EH&S

Training is provided by professional staff within each technical group. A more thorough discussion of each topic can be found in previous sections.

Topics
Accident reporting and investigation
Biosafety
Bloodborne pathogens
Chemical inventory
Confined space
Earthquake / Emergency response
Electrical safety
Fire safety / Fire extinguisher
Forklift safety
Hazardous Materials inspections (Santa Clara County)
Hazardous waste compliance
Hearing conservation / Noise
Ladder safety
Laser safety
Lockout / Tagout
Machine shop safety
Personal protective equipment
Radiation safety
Respirator fit testing and training
Supervisor IIPP

Stanford has implemented a central learning management system nicknamed STARS, Stanford Training and Registration System, to centrally manage all compliance related training records. EHS coordinates with the STARS management team to ensure that EH&S courses are represented in the STARS system and are available for individuals to take on demand. A greater percentage of EH&S courses are accessed through the online system. EH&S ensures that records are updated regularly and that department personnel have access to reporting tools to validate that training has been completed. The EHS Training & Communications group provides direct customer support to any trainees who have difficulty navigating the STARS system or accessing safety related training content.

Communications / Publications / Distribution of Materials

Written materials (inspection forms, training information, training documentation forms, etc.) are developed for the Stanford community to inform faculty and staff of health and safety regulations and topics and to assist them in carrying-out their health and safety training and communication responsibilities. The Stanford Safety Manual provides faculty and staff with useful health and safety information and guidelines. Originally, approximately 2500 written copies were distributed but now the EH&S website is the primary source of this information.

Distribution of Materials

Target information to specific audiences

The EHS website is the general repository of all EH&S resources. However the volume of material on the site has made it challenging for clients to find specific information that they need. Future versions of the site need to provide better access to EH&S materials and the ability to customize content based on a user's needs.

Develop new materials

New training is not always the most effective method of changing behavior. Often other solutions such as a targeted job aid or poster or other solution can be as or more effective at achieving the desired outcome. Understanding the desired behavior change is critical to devising an appropriate intervention.

Leverage new technologies

New devices such as tablet computers present new opportunities for delivering content that is more timely and adapted to a mobile environment. It opens up possibilities for development of more online checklists and inspection forms that were not previously available.

Stanford's IIPP Support

Recent efforts have focused on the General Safety and Emergency Preparedness online training module, which provides a standard baseline for all university employees. However gaps in the process still exist that allow individuals to avoid taking this important training element and it is much more difficult to identify who has not taken training than it is to identify who has taken training.

Recordkeeping



University Safety Partner Network

The University Safety Partners provide a principal point of communication for health and safety matters within the schools and departments represented by the USPs. Schools/Departments represented include Earth Sciences, Medicine, Engineering, Independent Labs, Centers, and Institutes, Humanities and Sciences, EH&S, Land Buildings & Real Estate, Residential & Dining Services, and Athletics. The Communications and Training specialist provides support to the University Safety Partner organization. It is critical that there be clear and effective communication between EHS and the safety partners so that programs are implemented consistently and thoroughly across the university. The above tasks require coordination with Human Resources, Learning & Development representatives, and University Safety Partners for effective implementation.

Accident follow-up system and Liaison work with Risk Management

Accident Investigation and Follow-up

The Injury and Illness Prevention Standard requires that there be a system for accident follow-up. EH&S has an accident investigation team that reviews all accident reports and follows-up, as appropriate. Appropriate personnel follow-up based on severity of incidents, at request of risk management, and where corrective measures are warranted. With the IIPP, a greater emphasis is placed on supervisors in terms of accident investigation. The SU-17 is used to assist supervisors with accident review and implementation of corrective measures. Risk Management will return the SU-17 to the supervisor if the supervisor statement is incomplete. The supervisor training will emphasize the importance of accident follow-up by supervisors.

Strengthening Ties with Risk Management

Liaison work with Risk Management includes handling special requests, coordinating on information needs and how best for Preferred Works to accomplish (e.g., quarterly accident reports for USP areas, summary information), feasibility of on-line processing of accident reporting forms.

Future Needs / Challenges

Throughout the University, greater consistency is needed in the quality and delivery of training programs. Following are some areas where this is needed:

Delivery and Coordination

Training needs to be delivered more consistently. Delivery of both Tier 2 and Tier 3 training programs varies widely throughout the University. Some schools/departments have developed good programs while others have weak programs or nothing at all. It appears that there will continue to be a need for a mix of centralized and de-centralized training. Programs need to be delivered using a variety of methods - live sessions, web-based modules, self-administered video, and self-paced interactive computer programs - to accommodate the needs of different audiences. EH&S is continually developing new web based training content to meet the needs of the university community.

Better Localized Training on Job Specific Issues

In general, there is a lack of documentation to verify whether the Tier 3 level of training has been occurring. No method is currently employed to audit or monitor training programs conducted by departments/schools/individual supervisors. New advancements in the STARS LMS combined with staff development plans may provide new opportunities for regularly documenting job specific training.

New Employees

All new employees are required to take the General Safety and Emergency Preparedness online course. While all the current reporting systems can easily determine who has taken the training, no consistent mechanism is available to determine who has not taken the training.

Faculty

Of particular concern are new faculty. It is critical that new faculty/Pis receive information prior to/during lab set-up. Additionally, faculty needs to be familiar with the regulations and requirements being placed on employees within their labs. This can vary widely from PI to PI and from school to school depending on the nature of the work being performed in the laboratory.

Recordkeeping

While the STARS system provides records of who has taken training, it does not effectively identify individuals who need to take training but have not. It is precisely this type of exception reporting that is critical to finding and eliminating gaps in the Stanford training program.

Compliance with Requirements for Mandatory Training

One concern is that participation in online safety training is not easily identified. Individuals need to be trained on the basic safety procedures to protect them from exposure to hazards in their laboratory environment. This can vary significantly. A Life Sciences Research Assistant in one department may require very different training from a Life Sciences Research Assistant in another department. Programs such as the Training Registration Questionnaire helps with this but a more comprehensive solution that ties training more directly to an individual is needed.

Module Development

Additional training modules are needed, including better tools for supervisors and PIs. As regulations continue to change and be implemented, new safety training modules need to be created and older modules updated. Technology is both an advantage and a liability as technical specifications for online course delivery continue to advance requiring that older technologies be phased out. While the technology may change, the training material must be maintained and converted to new technologies to be delivered to new audiences over ever changing delivery mechanisms.

Integration

The more that safety training can be integrated with the hiring and HR related processes, the fewer people will slip through the cracks and create a regulatory exposure by not taking safety training.



Business Continuity
Planning & Preparedness
Emergency Communications
Exercises & Training
Hazard Mitigation



Emergency Management

This institutional program provides guidance and oversight of the distributed emergency management projects across the university and develops policies, plans and procedures, and education and training to reduce the impact of minor and major emergencies on Stanford's population and programs. Because Stanford utilizes a decentralized management approach, many projects related to emergency management reside locally within individual departments or schools. The OEM team coordinates the execution of these multiple projects into an integrated emergency management program with common goals and objectives from within EH&S.

Supports these University Units:	Technical Services Provided	Business Drivers
<ul style="list-style-type: none"> Public Safety Emergency Management Steering Committee Departments and Schools General Workplace Settings Research Laboratories and Clinics Stanford News Service 	<ul style="list-style-type: none"> Planning and Assessment Emergency Operations Center (EOC) Response Teams Emergency Exercises and Preparedness Education Mass Notification Programs Hazard Mitigation Business Continuity Risk Assessments 	<ul style="list-style-type: none"> Disaster recovery and Business Continuity Incident Command System



Background

The Office of Emergency Management (OEM) is dedicated to developing programs that are: Comprehensive, Progressive, Risk-driven, Integrated, Collaborative, Coordinated, Flexible, and Professional. The Stanford Emergency Management Program is responsible for identifying and managing programs and projects that minimize or otherwise reduce the impact of emergency events to the university. A disaster may impact the university physically, monetarily, or reputationally and impair the ability of the university to conduct its core missions of teaching and research.

History

The existing program was established in 1996, when a Manager of Emergency Preparedness Planning and Safety Training position was developed at EH&S to restructure the University’s Emergency Plans and training programs, previously organized under Public Safety. The goals were to: Produce comprehensive University plans for a broad range of emergencies including: earthquakes, fires, major hazardous materials releases, extended power outages, mass casualty events and any major emergency (occurring on campus or in the community) that could interrupt Stanford’s mission-critical programs; Establish consistent supporting emergency plans throughout the University, and engage Schools and Departments in an ongoing process of planning for disaster response, recovery, and program continuity; Provide a range of training and education programs for Stanford faculty, staff, and students in order to sustain the University’s disaster readiness and response; and Serve as the planning liaison to the local, county and state government emergency planning organizations, as well as to other Universities.

Mandate

Program Elements

University policy governing the program includes *Administrative Guide Series 25*, and the University Cabinet’s instruction to implement the new Emergency Plans and establish the requisite ongoing programs (1997). Update to Board of Trustees (1999, 2003, 2010). Government regulation driving the program include the General Industry Safety Orders of Title 8 CCR; the emergency planning and evacuation orders included in Title 19 CCR, and the California State Code (Parts 40 & 59); Homeland Security Presidential Directive 5 (02/28/01), Management of Domestic Incidents (HSPD5); the Code of Federal Regulations (CFR), Title 44. Emergency Management Assistance; and the Higher Education Reauthorization Act (2008), Public Law 110-315.

Levels of emergency response

Emergency response is calibrated to address an emergency event of any scale:

Level	Scale
Level 1	Minor Incident
Level 2	Significant Event
Level 3	Disaster

Priorities for allocating resources are defined to protect life safety and resume normal programs and operations. Additionally, the University has a central Emergency Operations Center (EOC) facility with an EOC Emergency Management Team drawn from the University’s senior leadership. The EOC is currently located at the Faculty Club. The Public Safety Building Annex serves as a back-up EOC site with other alternatives available at the Ford Center, the Fire Training room at Public Safety and the Public Safety Command vehicle.

Overview

Planning and Assessment	Emergency Operations Center (EOC)	Response Teams	Biennial Emergency Exercises	Preparedness Education
<ol style="list-style-type: none"> Emergency Management Steering Committee Campus Emergency Plans Special Projects 	<ol style="list-style-type: none"> Levels of Emergency Response EOC Activation Department Operations Center (DOC) 	<ol style="list-style-type: none"> Situation Triage & Assessment Team (STAT) Stanford Community Emergency Response Team (SCERT) Post-earthquake Seismic Assessment Teams 	<ol style="list-style-type: none"> Basic orientations Table-top discussions Fully functional exercises that simulate actual disasters 	<ol style="list-style-type: none"> Department Training Publications and Electronic distribution Personal emergency preparedness
Mass Notification Programs (AlertSU)	Non-Structural Hazard Mitigation (ProtectSU)	Business Continuity (PrepareSU)	Campus Medical Response Plan	Risk Assessment
<ol style="list-style-type: none"> Mass notification system Outdoor warning system Emergency website Emergency Hotlines Public radio Social media technologies 	<ol style="list-style-type: none"> Critical, high value equipment protection Characteristics Specific research functionality 	<ol style="list-style-type: none"> Critical Functions Information and Strategies Action Items 	<ol style="list-style-type: none"> Communications Supplies & Equipment Security and safety Roles and responsibilities Utilities Patient care 	<ol style="list-style-type: none"> Asset Identification Threat Hazard Characterizations Susceptibility Vulnerability Consequence Assessment



Planning and Assessment

Each year EH&S updates Stanford's emergency plans and completes preparedness planning projects to address lessons learned from actual emergencies on campus or in the community. Additionally, this process anticipates new threats. For example, in 2009 emergency response plans were expanded as part of preparedness for infectious disease outbreak prompted by the H1N1 flu outbreak. New issues or modifications of plans or procedures identified by the biennial Emergency Management Exercise are also incorporated. Consistent planning throughout the University also entails the needs brought about by organizational changes at the University EOC, DOC, or department level. Finally, Coordination with other universities, local government, and updates to local, state or federal regulations are addressed.

Emergency Management Steering Committee

A permanent Emergency Management Steering Committee provides ongoing oversight and direction for the planning process and programs. The Stanford Department of Public Safety Chief of Police chairs the Committee and is the designated Stanford Incident Commander. The Emergency Manager staffs the Steering Committee, develops planning and training programs and coordinates special projects (such as biennial Emergency Exercises and resultant after action reports).

The Steering Committee meets 4-6 times a year and its additional members include: the Associate Director of Land, Buildings & Real Estate; Vice Provost of Student Affairs; Administrative Director of SHC/LPCH OEM; Director of Operations, Land, Buildings & Real Estate; Associate Vice President, Academic Projects & Operations; Director, Risk Management; Senior Associate Vice Provost, Residential & Dining Enterprises; Associate Vice President, University Human Resources; Director of Technology, Land, Buildings & Real Estate; Director, Vaden Health

Services; Associate Controller, Controller's Office; Associate Vice Provost, Environmental Health & Safety; Vice Provost Academic Affairs, Provost's Office; Assistant Vice President for University Communications, University Communications; Chair of the University Committee on Health and Safety; Executive Director, Internal Audit; Manager Emergency Management, OEM, Environmental Health & Safety; Compliance Office/ Interim Director, Student Financial Services; Director, University Communications / News Service; Vice President, Land, Buildings & Real Estate; Executive Director Computer Services, ITS; Senior Assistant to President, President's Office; and the Director, Public Safety.

Campus Emergency Plans

The principal components of Stanford's program include institution-wide planning defined by a Campus Emergency Plan, with integrated plans in Cabinet jurisdictions, and corresponding Department Emergency Plans. The plans are comprehensive, all-hazards plans designed to be applied to any emergency event. All response plans are multi-hazard or "generic" and can be applied to any type of emergency event.

Special Projects (includes planning and training elements)

Special Projects involved in planning and training include implementation of "Red Phone" backup communication lines between critical Department Operations Centers and the Emergency Operations Center; Coordination of the participation of key Department Operations Center staff in FEMA training courses for "Emergency Management for Higher Education". Additionally the program managed to direct a campaign to encourage Department Operations Center staff to complete basic Incident Command System training by completing the online FEMA course IS-100, Incident Command System for Higher Education. Emergency Management also participated in the University, School of Medicine, Hospitals Emergency Response (USHER) team meetings to facilitate communication and

coordination between the main campus, the School of Medicine and the Hospitals. The program coordinated distributed access to the AlertSU mass notification tool to allow independent Department Operations Centers to communicate with their local populations; developed and executed a plan for adding check-in capability to the AlertSU mass notification system to allow students, staff and faculty to "check-in" with the university after an emergency event; Provided technical expertise to the Global Incident Response Team dealing with issues unique to international students, faculty and projects in other parts of the world; and Provided technical expertise to the new campus mapping project. With the expansion of mapping technologies and GIS systems, there are many new possibilities for collecting, managing and mapping critical incident data. This will be a big area of expansion for the future. Emergency Management also established leadership in the field of emergency management beyond the university by engaging with the International Association of Emergency Managers Universities and Colleges Caucus. This provided opportunities to work directly with FEMA staff on the development of new course materials targeted for institutions of higher education including the L-363 course, Emergency Management Planning for Higher Education, and G-367, Emergency Planning for Campus Executives. Finally, the program contributed to the Palo Alto/Stanford Citizens Corp executive committee and working groups to advance cooperative planning in the Palo Alto region.

Emergency Operations Center (EOC)

The Stanford Emergency Operations Center (EOC) uses a modified version of the Incident Command System (ICS) model to organize its Management Team. The ICS model, which is mandated for use by California cities and counties and is also required for use by federal government agencies by the HSPD5, was adapted to suit our University environment. While the current EOC is located at the Faculty Club, the Office of Emergency Management is actively seeking alternative locations that



STANFORD UNIVERSITY

provide a greater assurance that the EOC will be available after a seismic event because the facility is constructed to a higher seismic standard, can be established in minimal amount of time and with a minimum of effort and can be used for incidents that do not escalate to a full Level 3 event.

EOC Activation

The EOC is only activated for full Level 3 (Disaster) events. When there is a Level 2 (Significant) event, a University Situation Triage & Assessment Team (STAT) activates to assess the situation, coordinate university response, interface with outside responding organizations and allocate university resources as necessary. The STAT team can either convene physically at a location or assemble virtually through the use of the standing STAT phone bridge that is available 24/7 (365 days a year).

Department Operations Center (DOC)

Twenty-four supporting Department Operations Centers (DOCs) in Cabinet-level Schools and Departments assist with organizing, planning and training before a disaster, and work directly with the central EOC during a disaster. DOCs gather impact data, execute strategic response plans and disseminate University instructions. DOCs also coordinate with the EOC to achieve a timely recovery of the University's academic programs and business functions. Current DOCs include 6 Operational and 18 Academic/Administrative headquarters in Schools, Departments, and Stanford Auxiliaries. The Operational Services DOCs include Public Safety, Environmental Health & Safety, Land, Buildings & Real Estate, Information and Technology Services, Residential & Dining Enterprises, and the Vaden Student Health Service.

Administrative & Academic DOCs

1. School of Business
2. School of Earth Sciences
3. School of Education
4. School of Engineering
5. School of Humanities/Sciences
6. School of Law
7. School of Medicine
8. The President and Provost's Office
9. Vice Provost, Student Affairs

10. Vice Provost and Dean - Research
11. Alumni Association/Development Office
12. Office of the Chief Financial Officer & Business Affairs
13. University Librarian's Office
14. Department of Athletics, Physical Education and Recreation
15. SLAC National Accelerator Laboratory
16. The Hoover Institution
17. Stanford Management Company
18. Stanford Campus Residential Leaseholders

The University Emergency Management Office also coordinates efforts with the Stanford Hospital & Clinics Office of Emergency Management to ensure clear communication and effective response during an emergency.

Formation and Development

The 24 Department Operations Centers are critical to the University's emergency management capability because they incorporate Stanford's decentralized physical and organizational structure into the University's emergency management program. The DOCs promote preparedness within their jurisdictions by obtaining EH&S hazard reduction consultations and appropriate training for their staff; gather critical impact information for the EOC and disseminate University instructions during a disaster situation; execute strategic response priorities as communicated by the campus EOC; coordinate their area's program recovery and resumption with the University; and in the case of Operational DOCs, provide critical services to the campus during an emergency.

EH&S provides special training for DOCs to ensure their effective participation. Each year DOC personnel are invited 4-6 training seminars, which include planning workshops for DOC managers (consistently attended by well over 90% of the DOCs). Topics include: Incident Command System training, University plan and project updates, Local planning responsibilities, Business and program recovery coordination, Disaster cost documentation, and Improving the planning process. Additionally, training exists for Stanford's post-earthquake "Building Assessment Teams (BATs)"

who are recruited by EH&S and the DOCs. The BATs were created by EH&S in 1998 to support the campus EOC by performing preliminary local damage reconnaissance. The current BAT team is composed of over 600 volunteers trained in the ATC-20 Post-earthquake Safety Evaluation of Buildings technique. Training is offered annually for new BATs and refresher training for existing BATs is offered every other year. Additionally, DOCs facilitate coordination between EH&S and their constituent departments to develop unit level disaster response and recovery plans that are consistent with the campus wide Plan. EH&S provides DOCs and their constituent departments with safety evaluations and recommendations for mitigating local hazards, and advises them on how to organize with appropriate leadership, and emergency supplies or equipment.

Response Teams

Situation Triage & Assessment Team (STAT)

The STAT is composed of key operational managers within the University who have the authority to re-allocate resources as necessary to respond to an event. Depending on the nature of the event, one of the STAT members will assume the role of Incident Commander for the duration of the incident. The STAT includes individuals from: Public Safety, Environmental Health & Safety, Buildings & Grounds Maintenance, Land Buildings & Real Estate, IT Services, University Communications, Residential & Dining Enterprises, Office of Emergency Management, President's Office, Provost Office, Student Affairs, Vaden Student Health Services, Risk Management, and Stanford Hospital & Clinics.

Examples of recent STAT team activation events include:

Event	Date
Cogen loss of steam capability	08/17/12
PG& E Power outage to housing	08/02/12
Partial Power outage to campus	04/17/12
Cogen loss of steam for SHC	02/28/12
Gas Main Break	01/25/12
Report of shots fired on campus	05/04/11
Power Outage in Housing	03/10/10
Power Outage in Palo Alto <i>caused by small plane crash near Palo Alto airport</i>	02/17/10



Power Outage on campus	01/19/10
H1N1 Outbreak response (initial)	05/29/09
Data Power Failure in Forsythe Hall	08/18/08
Power Outage on campus (partial)	12/15/07

Development and Improvement

After a study of multiple potential EOC sites was made in 1998 the Faculty Club was selected as the interim site of the Stanford EOC. Infrastructure improvements were made at the Club (such as the installation of dedicated telephone lines, storage of basic supplies and display systems) to make the space a credible emergency management center. Additional improvements have been necessary in the intervening years to provide the EOC Management Team with critical equipment and information. Enhancements include acquisition of radios and satellite phones to facilitate communications in an emergency. Redundant phone connections were also installed to provide multiple options for communications. A central EOC data server was developed to serve as a repository for critical university information that may not be accessible through central systems in the early stages of a response. These data sets are updated and refreshed on a regular basis and include items such as facility floor plans, student housing lists and procurement database information. Additionally, hazard assessment databases were developed, critical for EOC decision-making. This includes a Hazardous Materials Index (HMI) to summarize chemical-biological-radiation risks in campus buildings, and a Seismic Database (developed and maintained by LBRE) that details construction types and potential earthquake damage. Up-to-date EOC Map Books were produced that display "at-a glance" summaries of: Current building occupancy (and the distribution of dependent populations), evacuation area sites & outdoor emergency phones, seismic ratings for buildings, locations of hazardous materials, fire sprinklered buildings, electrical service and emergency generator sites, utility shut-offs, and communications hubs. Additionally, an EOC Operations Guide was developed, which includes instructions and action checklists for EOC management groups, Contact information for both the EOC and DOC personnel, a directory of University resources and supplies, and Information on current contractors and mutual aid contacts.

Stanford Community Emergency Response Team (SCERT)

During an emergency event, it is likely that the City of Palo Alto will not be able to provide the full range of emergency services support that it is capable of providing on a daily basis. In preparation for just such an event, Stanford has adopted a model of self-sufficiency in a variety of programs. In order to provide additional emergency responders trained to a higher level of capabilities, Stanford developed a team following the Community Emergency Response Team model for the Stanford campus. Members of the team are trained to provide additional emergency support in the aftermath of an emergency when first responders are unavailable. SCERT members are attached to the Department of Public Safety during an emergency and serve as an additional resource for the DPS organization. Volunteers receive an intensive course of training over 20 hours. As of 2011, the Stanford Community Emergency Response Team has over 200 fully trained members many of whom have taken advantage of multiple advanced level courses that are offered on a periodic basis. SCERT members are incorporated into campus events and exercises to provide them with additional training and periodically allow them to exercise the skills they were taught during their training.

Biennial emergency exercises

After the Fall 2006 earthquake exercise, the Provost requested that full scale emergency exercises be conducted every other year. In January 2009, an exercise was conducted followed in Fall 2010 by a campus building evacuation exercise. These special exercise programs have evolved from basic orientations to the Emergency Plans and the Emergency Operations Center facility, to table-top discussions of disaster policy and strategy, to fully functional exercises that simulate actual disaster decision-making, communications, and resource allocations. The program has nearly 100% participation from senior University management, and practices a variety of emergency procedures. These procedures include:

activating the University's EOC and Emergency Plans, defining resource priorities and needs, and interacting with campus Department Operations Centers. Each exercise identifies critical issues and gaps in EOC and DOC functionality, and those are addressed and resolved as action items within the following year's planning projects. Recent exercises include: Department of Homeland Security Executive Education Seminar tabletop organized by Public Safety to raise awareness of cross jurisdictional issues during event response on February 4, 2010, the Campus-wide emergency evacuation exercise on October 7, 2010, and the multi-jurisdictional Stadium response exercise on September 9, 2010. Operational DOCs and full DOC group engaged in tabletop exercises using an active shooter scenario in 2012.

Preparedness Education

Stanford's emergency response is dependent on the successful implementation of emergency procedures at the local DOC level. As departments and individuals throughout the University better understand their role during an emergency and have taken the responsibility to prepare themselves for emergencies and disasters, the more effective all of the university plans will be. Therefore, EH&S has a proactive emergency preparedness education and training program, which includes Department Training, Publications and electronic distribution of preparedness information, and the Stanford Community Emergency Response Team (SCERT) to support education and training efforts. Ongoing coordination with the University Safety Partners enhances all of these training and education efforts.

Department Training

Personal Emergency Preparedness classes are offered on a monthly basis for any interested staff and faculty. The class specifically focuses on steps that an individual or family can take to be better prepared for a variety of emergency circumstances. The class was revised as of September 2009 and has enjoyed a significant increase in participation as a result. Annual class attendance was a mere 30 in 2008/2009. From 2009/2010, 342 individuals attended the course. Since the new course was instituted in 2009, over 900 staff and faculty have taken the course



STANFORD UNIVERSITY

through October 2012. In addition, special presentations are scheduled in campus departments throughout the year upon request. Recent examples include: Department of Chemistry, Blood Center, SLAC and Student Affairs Staff. The revised Personal Emergency Preparedness class also qualifies staff for a BeWell Berry as part of the university Health Improvement Program. EH&S preparedness trainings are also part of annual new student orientations in Biology, Civil Engineering, Electrical Engineering, Mechanical Engineering, Chemistry, and the School of Earth Sciences. The Emergency Manager, along with the Fire Marshal's Office, provides evacuation training each year to new students, faculty, TAs, Resident Assistants, and ushers for sports and entertainment events. The training includes an orientation to the emergency response and evacuation procedures including the location of local Emergency Assembly Points (EAPs). EAPs are now in place for every building on the main campus and the Medical Center.

Publications and Electronic distribution

EH&S has leveraged new technologies to expand the reach of the emergency preparedness message to online systems. The EH&S website hosts an *Emergency Guide for Faculty and Staff* that can be viewed online in an interactive format or downloaded in part or in full as a pdf document for printing. The iStanford iPhone application now contains a specific section for emergency information. This interim placeholder will be replaced with more specific information as the capabilities of the platform are further explored.

Publications developed to support education and training include the :Online Emergency Guide for Faculty and Staff, Emergency Preparedness for Students, Faculty, Staff & Visitors (brochure), Be Quake Safe at Stanford (brochure), Instructor's Guide to Earthquake Preparedness (brochure), Winter Storm Preparedness & Response Tips (flyer), Power Outage Preparedness (flyer), Evacuation educational materials (EAP maps, evacuation leader instructions/flags), Stanford Emergency Information Wallet Card: distributed to every entering student, produced as an EH&S training handout,

and printed in the campus telephone directory, Emergency Hotline Phone Sticker – distributed in EH&S trainings and by Telecommunications, and Ongoing improvement of Preparedness web pages information. All publications were transferred to downloadable formats to encourage local printing by departments and other users

Mass Notification Programs (AlertSU)

In the aftermath of the Virginia Tech disaster, universities across the nation, including Stanford, revisited their emergency communications capabilities to determine whether they had the proper combination of communications systems to effectively alert their campus community to an ongoing or emerging threat to safety. As a result of this analysis, Stanford determined that improvements were necessary. The Emergency Management office developed a multimodal notification strategy that is now commonly known on campus as the AlertSU system.

AlertSU is the Stanford University emergency notification strategy used to communicate time-sensitive information during an emergency event affecting campus. The system is comprised of a mass notification system, an outdoor warning system, emergency website, emergency information hotlines, public radio and social media technologies. The mass notification system delivers notifications via voice mail, email and text-messaging to members of the Stanford community. The outdoor warning system is a series of seven sirens which use a combination of alert tones and verbal instructions to deliver information to anyone outdoor on campus. These are the push methods for delivering information to the campus community. Community members can "pull" information by visiting the emergency information hotline (650) 725-5555 or emergency website <http://emergency.stanford.edu>. Emergency management personnel respond to an event, assess the situation and determine whether use of the AlertSU tool is appropriate.

Stanford took the unusual approach of automatically "opting in" all Stanford provided email addresses and phone

numbers for all staff, faculty and students. This approach virtually ensures that an effective majority of the campus can be reached during an emergency. Students are required to provide one additional emergency contact point during registration for classes each year. This approach has avoided the problem that other campuses have encountered when using an "opt-in" strategy that requires staff and students to actively register for emergency alerts. This approach has met with very low participation rates and ineffective notification strategies. The Office of Emergency Management continuously monitors technological changes that present new capabilities for mass notification and implements modifications as appropriate. The recent improvement to the AlertSU system added the ability for staff, faculty and students to actively respond to an emergency notification and check-in with the university. This capability was fully implemented in 2012.

Non-Structural Hazard Mitigation Program (ProtectSU)

An earthquake impacts an educational campus in a variety of ways. The most obvious impacts are to people who are injured or buildings that are damaged. As an educational institution and a major research center, the impact can be felt just as strongly by the programs that are interrupted and the research that is damaged or lost as a result of the shaking. The ProtectSU program provides a process to mitigate the interruption to research and get programs back up and running more rapidly by protecting critical, high value equipment from damage during an earthquake by restraining it to prevent movement and damage. The ProtectSU program provides a structured process for systematically restraining high value equipment, creating a sustainable restraint program, integrating the restraint program into existing procurement and equipment management processes, and providing some financial assistance from the university to encourage departments to participate in the program. The ProtectSU program is documented at the program website at <http://protectsu.stanford.edu>. This site provides technical guidance for properly restraining equipment base on



equipment characteristics such as size, weight, physical location, and specific research functionality such as being vibration sensitive or needing to maintain equipment mobility. This program will be fully implemented over the course of multiple years. Current estimates indicate that it will take up to five years to complete the entire program using a systematic approach of starting with the most vulnerable buildings with the greatest potential for loss and proceeding building by building through the campus.

Business Continuity Program (PrepareSU)

In addition to addressing the physical components of an emergency event, the Office of Emergency Management is proceeding to address the functional component by providing a process to assist departments with developing local business continuity plans. The goal of continuity planning is to enable the University to continue the primary missions of teaching and research despite emergency events. Some departments will be expected not only to continue but to expand their services during these times.

The PrepareSU tool guides department planners, step by step, through the process of creating a continuity plan. The plan will identify:

1. **Critical Functions** performed by the department, and the factors needed for their continuance.
2. **Information and Strategies** that will help during and after the disaster-event.
3. **Action Items** that can be done, starting now, to lessen the impact of events and make the department ready to cope.

The tool is designed for departmental continuity planning. Department is loosely defined as any sub-unit of the campus. It can be defined as an entire school, department or division, or as small as an individual laboratory unit. The tool is appropriate for all types of departments - instructional, research, patient care, as well as administrative and other support units.

Effective continuity plans help departments and units identify their most critical functions and devise contingency plans to ensure that those functions can continue during a disruption or can be restored promptly to reduce the impact of the event. The Office of Emergency Management will spearhead this effort by providing the following resources to departments: Electronic tool to facilitate department plan creation and maintenance (PrepareSU); Written and online guidance materials for departments engaged in continuity planning; Training on the effective use of the online tool and on the continuity planning process in general; Consultation for departments with questions or issues on effective continuity planning strategies; Monitoring of planning results for trends and gaps that are most effectively addressed on an institutional basis rather than by multiple individual departments; and Research and Publications of additional resources available to assist departments with mitigation strategies.

Campus Medical Response Plan

As part of the Emergency Management for Higher Education (EMHE) grant that Stanford received in 2009, Stanford developed the framework for a comprehensive medical response plan for the campus. The purpose of the Stanford University Campus Medical Response Plan (CMRP) is to describe how Stanford University will conduct a medical emergency response to and recover from a major emergency that threatens the health and safety of the campus community or disrupts its programs and activities.

The Stanford University CMRP has been developed through close collaboration among Vaden Health Center, Environmental Health & Safety, other partners within Stanford University, and external stakeholders in the community. The plan was developed to meet accepted standards and guidelines from the Accreditation Association for Ambulatory Health Care, Inc., the American College Health Association, and the Joint Commission. The plan describes how Vaden Health Center will operate during an incident. The plan includes several key

tasks that are required for an emergency plan, including: Maintaining communications, Providing supplies, Maintaining security and safety, Managing staff roles and responsibilities, Providing for utilities, and Managing patient care, including clinical and support activities.

As of the end of 2011, the plan is in draft format. Additional development will take place by validating the assumptions and procedures in the plan with internal partners and external stakeholders. After the plan has been finalized, implementation of the full plan is expected to take a year or more before Vaden and its staff are fully prepared to execute the plan fully in the event of an emergency.

Risk Assessment

Another component of the EMHE grant was the development of an Emergency Management Risk Assessment model for Stanford University that incorporates the unique characteristics that are important to an institution of higher education such as Stanford. These factors have been integrated into a tool that helps categorize, classify and rank the various threats that Stanford may face. The output of the tool provides the framework for making informed decisions about targeted mitigation strategies and plans. After mitigation plans have been implemented, the risk assessment calculation can be re-evaluated to indicate whether the implementation has had a significant impact on reducing overall risk.

The Emergency Management Risk Assessment Tool incorporates: Asset Identification (people, facilities, and infrastructure), Threat Hazard Characterizations (natural hazards, human-related events, terrorism, and technological hazards), Susceptibility, Vulnerability, and Consequence Assessment (health / safety, financial, mission, and reputation impacts). The Risk Assessment tool will require the combined efforts of multiple campus partners to provide input on the evaluation of the various scenarios. The products of the tool are most valuable when broad spectrums of perspectives are represented during the evaluation process. The tool will be continuously developed and improved in the coming years.



Principal Program Challenges (2011–2015)

The near-term goal is to expand preparedness and training programs to address the unique issues of interdisciplinary buildings and improve life safety/evacuation procedures for all areas of campus and address the most pressing deficiencies in our response planning/training. The following priorities will keep emergency preparedness moving forward while budget constraints pose severe challenges.

Implement EMHE grant program products

Emergency Management plans to implement the recently completed ***Campus Medical Response Plan***, which is an essential component in Stanford's disaster preparedness. Full implementation of this plan will provide limited medical care for both students and on-campus staff and faculty. The grant will provide a limited supply of medical equipment for Vaden. It is possible that additional materials will be necessary as the plan is fully realized. Additional steps include: Training medical personnel at Vaden on their expanded responsibilities, Training DOC-based volunteer first-aid teams to provide local disaster assistance & support Vaden, Assisting Vaden and Medical Center's location of a disaster supplies cache site, and Testing disaster coordination and communication between Vaden and the Medical Center. Another goal is to implement ***Business Continuity Planning*** across the university. This includes: engaging critical departments in using the PrepareSU tool to develop contingency plans to address their most critical business processes, providing training to campus organizations to increase coverage of continuity plans, and developing annual reports on the progress of continuity planning across the university and provide to the Emergency Management Steering Committee and University executive management.

Implement the ProtectSU seismic non-structural mitigation program

The program will continue to mitigate earthquake losses through implementation of the ProtectSU Non-structural Hazard Mitigation Program. This entails expanding the ProtectSU program to protect additional high value equipment, streamlining the process for obtaining and installing restraint equipment, and integrating data collection

with the university equipment inventory system.

Expand training opportunities for EOC and DOC staff and staff, faculty and students

To strengthen DOC preparedness and management, Emergency Management shall provide targeted training to specific underdeveloped DOCs, develop strategies to encourage a move toward building centric life safety plans, continue to encourage completion of FEMA Incident Command System training for DOC personnel, and expand distribution of educational materials through new mobile technologies (leveraging smartphones and iStanford capabilities to provide low cost high penetration distribution of emergency procedures to students, faculty and staff). Additionally, the program plans to develop more effective faculty and PI preparedness instructions through existing faculty publications and communications channels, and orient instructors on classroom emergency procedures and their responsibilities.

Improve Data Collection and mapping procedures

In order to investigate opportunities for leveraging the new campus mapping solutions to facilitate the collection and management of emergency response information, Emergency Management will work with LB&RE to expand the capabilities of the campus maps to view and manage a distributed data collection process. In addition, the program will partner with the Department of Public Safety to ensure that first responders have access to important data when responding to incidents on campus.

Improve existing and backup EOC facilities

The program will make EOC improvements by continuing to pursue an EOC solution for the campus that can provide dual-purpose use while minimizing EOC setup logistics by identifying appropriate locations for an improved alternate EOC on campus. Additionally, Emergency Management will ensure consistency between primary and alternate campus EOC facilities, establish and train back-ups for the University's EOC Team, and continue to provide pre-Exercise training for all EOC management groups.

Improve inter-agency coordination

An important goal will be to improve communications between Stanford and local jurisdictions regarding emergency response and expectations including the City of Palo Alto, County of Santa Clara and State of California Emergency Management Agency. This includes clarifying procedures for emergency communications between local government organizations and Stanford.

Develop Laboratory Response Strategies to address unique issues associated with hazardous materials

The program will establish/train supporting volunteer teams to speed disaster hazmat inspections, and the proposed Hazard Assessment and Reconnaissance Response Team (HART). Volunteers with accurate lab impact information will help the University prioritize lab clean-ups after a disaster. This new EH&S training will clearly specify Level 2 and Level 3 emergency roles and responsibilities, define protocol for linkages with other response personnel, and train School of Medicine as a model for training additional teams to cover all campus lab areas.

Expand the campus exercise program

The program shall integrate both the 1) Homeland Security Exercise and Evaluation Program concepts of conducting exercises of progressively increasing complexity, and 2) additional tabletop exercise scenarios for Department Operations Centers and Operational DOC staff.

Strengthen readiness for Level 2 emergencies

This entails integrating new AlertSU capabilities for Level 2 emergencies and STAT response, holding regular Situation Triage and Assessment (STAT) notification tests, and practicing the management and coordination of a variety of Level 2 scenarios.

Develop comprehensive Mitigation Plans for the University

Emergency Management will document existing mitigation measures already in place, evaluate additional mitigation projects as indicated by the results of the EM Risk Assessment tool, and develop proposals and strategies to implement further mitigation strategies.



Data Integrity
Regulatory Reporting
Chemical Safety Information
Reference



User ID:

Password:

[Send Me My Password](#)

[Submit a ChemTracker Help Request](#)

ChemTracker



Chemical inventories are maintained for every area containing hazardous materials at Stanford University as well as at Consortium member campuses. Chemical owners (e.g., Principal Investigators, area managers) are responsible for ensuring their chemical inventories are up-to-date in the University's inventory system using the ChemTracker (CT) online inventory system. The ChemTracker team is responsible for ensuring that the program is operational 24/7 and updated to remain current with regulatory changes.

Supports these University Units:	Technical Services Provided	Business Drivers
<ul style="list-style-type: none"> Research Laboratories and Clinics General Workplace Settings Facilities Service Operations Construction / Renovation 	<ul style="list-style-type: none"> Reference Database / Data Integrity Regulatory Reporting Chemical Safety Information ChemTracker Consortium 	<ul style="list-style-type: none"> Laboratory Standard and Hazard Communications Standard (8 CCR) Regulatory compliance



Program Elements

Overview

Reference Database	Regulatory Reporting	Chemical Safety Information	ChemTracker Consortium
<ol style="list-style-type: none">1. Hazardous materials inventories2. Regulatory compliance3. Physical / health hazard safety and regulatory information4. Regulatory reports5. Building / fire code assessments	<ol style="list-style-type: none">1. Hazardous Materials Business Plan Reporting (HMBP/HMMP)2. California Accidental Release Prevention (Cal ARP)3. Spill Prevention Countermeasures Control (SPCC)4. Aboveground Tank Management (AGT)5. Toxic Gas Reporting (TGO)6. Bay Area Air Quality Management District (BAAQMD)	<ol style="list-style-type: none">1. Material Safety Data Sheets (MSDSs)2. Chemical-specific information resources	<ol style="list-style-type: none">1. Help desk portal2. Data and technical problems3. New member management4. Membership meetings5. Newsletter

Background

ChemTracker is a web-based relational database for the tracking of hazardous materials inventories, compliance with numerous local, state and federal regulations, linking of inventory to physical/health hazard safety and regulatory information, production of regulatory reports and assessment of building/fire code implications driven by specific inventories related to construction projects. The operational support for this involves: Administrative tasks to support current and new Consortium members as well as inform and recruit prospective members (2.0 FTE); IT tasks to establish new member server installation, i.e. 'instance', space; Data Integrity group support new member with initial data uploads; Data Integrity group maintains and advances Reference Database; and Customer Support, Data Integrity, and IT troubleshoot and correct.

Major Upgrade

The ChemTracker program must remain flexible yet stable to be able to evolve and respond to changes in regulations, new data management technologies and best management practices. This is particularly challenging in a research focused academic environment. The ChemTracker Program group is currently defining the scope of and developing the functional requirements for a major upgrade to the software program. This major upgrade will focus on designing and implementing a more stable and sustainable software architecture

that will provide greater flexibility in both troubleshooting any program errors, incorporating new functionality and providing for future application – program interfaces, e.g., ChemTracker program access and usage via handheld devices. In addition, the upgrade will introduce a more intuitive, user-friendly interface that will have the benefit of greater efficiency and a shorter time to proficiency learning curve. The target implementation of the core upgrade is June 2012.

Reference Database

Purpose / Goals of Data Integrity

Purpose / Goal: Maintain an accurate, extensive database of the physical and health hazards associated with specific chemicals and chemical mixtures; associate regulatory requirements, storage guidelines, fire code classification and synonyms with specific chemicals/mixtures. Reference database is the core data repository from which other ChemTracker program functions draw. The core reference database is a listing of 35,000 discrete chemicals and chemical mixtures which have been classified for physical properties, physical and health hazards, storage requirements, and regulatory requirements (see Chemical Safety Information section below). In addition, the reference database associates synonyms with specific chemical names for a total of 100,000 synonyms. The reference database is continually updated.

The ChemTracker Data Integrity Group (4.5 professional FTE plus 0.5 FTE student assistants) oversees and manages the reference database. The tasks for maintaining the reference database includes: Classification of chemicals and chemical mixtures for addition to the reference database; 20 – 30 minutes per chemical; minimum validation of data with 3 separate reference sources; Reconciliation, correction of conflicting classification data; Response to Consortium member requests for classification of specific chemicals; and Maintenance of automatic and semi-automatic linking functions (e.g., AMONSing and SAMONSing), which allow new user added entries to be associated with existing reference database chemicals. The reference database is the source of chemical-specific information from which the regulatory reporting functions draw and associate that data with given inventories to produce inventory-specific reports. The Data Integrity Group, with support from EH&S IT, maintains the reporting functionality of ChemTracker (see Regulatory Reporting section below). The reference database also supports the ad hoc search query functions whereby users can selectively search their inventories by one or a combination of 28 different data fields.

Regulatory Reporting

Purpose / Goals



STANFORD UNIVERSITY

Maintain an accurate, extensive database of the physical and health hazards associated with specific chemicals and chemical mixtures; associate regulatory requirements, storage guidelines, fire code classification and synonyms with specific chemicals/mixtures. Reference database is the core data repository from which other ChemTracker program functions draw. (*Regulatory Drivers: California H&S Code § 11100 – 12000, 25509, 25506, 25503.8, 25244.10, 25249.10, 25282, 44342; County of Santa Clara Hazardous Materials Storage Ordinance; California Labor Code Sec. 9020; California Public Resources Code Sections 21000-211768; 8 CCR 2770.5, 3203, 85194; California Building Code Chapter 319; City of Palo Alto Municipal Code Chapter 13; and the SF Bay Regional Water Quality Control Board National Pollution Discharge Elimination System permit*)

Colleges and universities nationwide must submit annual hazardous materials inventory statements to multiple regulatory agencies. This reporting obligation is particularly onerous for research universities given the extreme diversity of different chemicals, distributed across many buildings and thousands of rooms. The EH&S Hazardous Materials Management program uses ChemTracker to document and report on Stanford's chemical inventory that is comprised of 15,011 different chemicals in 250,089 separate containers distributed across 2,625 rooms in 264 buildings. The ChemTracker reference database and report generation functions are the key to Stanford complying with these numerous reporting requirements. Likewise, ChemTracker Consortium members heavily depend upon the ChemTracker reporting functions to meet their regulatory reporting obligations.

The Data Integrity group maintains the ChemTracker reporting functions which compare the chemical name plus physical and health hazard information with the regulatory chemical lists and tables of properties from a library of 212 discrete regulatory citations. The report function then compiles all the positively associated inventory entries and places them in the required report format. The information maintained in ChemTracker is used for safety, community right-to-know and environmental compliance programs. Listed below are some of the programs that ChemTracker supports for Stanford and the

corresponding regulatory drivers that are fulfilled. **Programs with inventory reporting requirements** include the: Hazardous Materials Business Plan Reporting (HMBP/HMMP), California Accidental Release Prevention (Cal ARP), Spill Prevention Countermeasures Control (SPCC), Aboveground Tank Management (AGT), Toxic Gas Reporting (TGO), and the Bay Area Air Quality Management District (BAAQMD).

Chemical Safety Information

Purpose / Goals

(*Regulatory Drivers: 8 CCR 5194(e)(A), (g)(1)(10), (h)(1); SARA Title III, Section 311-312; 8 CCR 5191(f)(3)(E)*)
Provide access to chemical safety information and Material Safety Data Sheets (MSDSs) independent of a user's specific inventory. Information resources provide chemical-specific health and safety information critical in ensuring safe chemical handling and storage. ChemTracker inventory program and associated chemical safety database and MSDS service are the primary means of providing this information. The ChemTracker program is also a source of chemical safety information that is used by EH&S safety professionals, chemical users and emergency response personnel. It is a core requirement of OSHA's 'Lab Standard' and 'Hazard Communication Standard' regulations that employees have easy direct access to health and safety information in their work area on the hazards to which they may be exposed. ChemTracker provides very specific information on the physical and health hazards presented by a given chemical or chemical mixture along with safe storage guidelines. In addition, a user can access, via a link from ChemTracker to an outside source, a Material Safety Data Sheet (MSDS) for a specific chemical of interest. Quick access to MSDS information is also required by OSHA regulations. ChemTracker also provides a chemical inventory summary by hazard class along with a room inventory for emergency response personnel via the Life Safety Box report. The Life Safety Box report also provides a cover page that presents a quick reference with DOT icons as to the major hazards. This provides first responders a quick snap shot chemical hazard profile of a particular room. The Data Integrity

group provides the operational support to ensure that the Reference Database is up to date and operational to supply the chemical safety information.

ChemTracker Consortium

Purpose / Goals

The Consortium is a membership-based collaboration of more than 32 colleges and universities whose ChemTracker members use services and applications to effectively address complex and increasingly costly chemical management and regulatory reporting requirements.

The ChemTracker Consortium currently has 31 members including Stanford, CUNY (with 20 discrete campuses) as well as 4 new members this year: Eastern Virginia Medical School; Texas A&M Health Science Center; TSRI Florida; and, St. Francis College. The ChemTracker group supports the Consortium members by: Maintaining a help request portal (chemtracker_support@lists.stanford.edu); Responding to and correcting data and technical problems; Assisting new members in getting their ChemTracker instance (installation) implemented; Convening an annual Consortium membership meeting at the CSHEMA conference; and Composing and disseminating a quarterly ChemTracker Program newsletter. The Stanford ChemTracker program also promotes collaboration within the Consortium and higher education community with increased outreach. This outreach included two trips by Kevin Creed, the ChemTracker Program Manager: one to the annual Campus Safety Health & Environmental Association (CSHEMA) to network with prospective ChemTracker members and meet with current Consortium members. The second trip, in September, was to speak at the New York City Environmental Resource association quarterly meeting about tracking hazardous materials on campuses and meeting the requisite reporting mechanism with software programs and, in particular, ChemTracker. He also took the opportunity while in the New York and Boston region to meet with other Consortium members who were not able to attend the CSHEMA meeting.



Applications
Integration Services
Infrastructure
Programming
Web Management

Information Technology (EH&S IT)

The Information Technology (IT) group provides a wide range of project and operational services to the Environmental Health and Safety (EH&S) program areas. Services include application development, integration services, infrastructure, project and program support, application monitoring and support, resource management, website management, desktop support, and ChemTracker support.

Supports these EH&S Units:	Technical Services Provided	Business Drivers
<ul style="list-style-type: none"> • Administration • BioSafety • Hazardous Materials • Health Physics • Training 	<ul style="list-style-type: none"> • Applications (Development) • Integration Services • Infrastructure • Programming • Web Management 	<ul style="list-style-type: none"> • ChemTracker • Hazardous Waste • STARS



Program Elements

Overview

Project Services	Operational Services
1. EH&S Administrative Systems (application development)	1. Application Monitoring and Support
2. ChemTracker Systems (application development)	2. Website Management
3. Integration Services	3. Desktop Support
4. Infrastructure	4. Infrastructure Support
5. Project and Program Support	5. ChemTracker Instance and Programming Support

Background

Currently, the IT groups counts seven full-time professionals where 57% of the resources are used for projects and the remaining 43% is utilized for operational services. Over the past year, about 60% of IT-managed resources have been allocated to the ChemTracker program. Recently, this has moved down to about 30% but it is expected to require additional resources in the near future. Over the past couple of years, the information technology at EH&S has evolved in the following areas: Outsourcing of all locally hosted servers to the Forsyth facility; Added business analyst and project management capabilities; Increased technical support for ChemTracker; and Increased outreach to other University organization such as Administrative Systems (AS), Lands, Buildings and Real Estate (LBRE) and Information Security Office (ISO).

Looking forward the next two years, the IT group will have special focus on the following areas of goals: 1) *Workstation and Laptop Standardization* (including Novell to Microsoft Server and Authentication Migrations, Hardware Mapping, Windows 7 Enterprise Upgrade, and Office 2010 Upgrade); 2) *Electronic Process, Document and Collaboration Improvements* (including Departmental Document and Records Management, New EH&S web site, Electronic Work Order Management (eAM), and Asbestos Program Management (eAM derivative)); 3) *Health Physics System Improvements* (including SHPII Phase I: SHP Replacement, and SHPII Phase II+: Self Service, Systems Integration and Other Improvements); 4) *Application and Data Security and Robustness* (including Application-Data-User Mapping, Data Classification, IT Continuity Plan, New Oracle Database Server Platform, New Application Server Platform, Server Redundancy at Livermore Server Facility, Laptop Encryption, and Backup Solution for Laptops); 5) *ChemTracker Projects* (including Addition of application servers, Potential UC implementation and collaboration, and New ChemTracker); 6) *Mobile Strategy*; 7) *Integration* (including Person Registry Integration, FAMIS Integration, and STARS Integration); and 8) *Software Development Process Improvements* (including Source Control, Bug Tracking, Configuration Management, and Project Site).

The IT group is not planning on embracing Cloud Services and VOIP in this time frame. However, we are aware of the fact that some of these initiatives may be initiated from outside EH&S. At current time, only the upcoming ChemTracker project would require additional people and space resources; the ChemTracker project charter will facilitate this estimate. Major anticipated non-

labor costs associated with the above goals would include: New application and database servers, Ongoing replacement of old desktop and laptop hardware, and Windows 7 and Office 2010 licenses.

Project Services

EH&S Administrative Systems (application development)

The current development methodology, embraced by the IT development group, entails a process that merges practices from the agile software development, water fall development and prototyping software development. The implementation scope is divided into manageable iterations that each consists of the following phases: 1) The requirement and basic design phase entails elaborate business, functional and workflow requirements and basic screen layout. The business analyst is the lead of this phase which includes common requirement and design sessions with end users and technical development team. The deliverables of this phase are elaborate requirements, basic layout and job aids; 2) Technical development of user interface (Adobe Flex, HTML/AJAX), business processes (PL/SQL Oracle Stored Procedures) and database objects (Oracle Database). All technical deliverables will be tested by the business analyst to prepare the User Acceptance Testing (UAT). Occasionally, some pieces will be submitted for test by select users to verify the requirements; 3) The UAT starts with a common session where the business analyst runs through the functionality and job aids to be tested by the end users. Hereafter, the users will test the system and report back to the business analyst who will determine whether a finding is a bug to be fixed, a training issue, or an enhancement request that will be implemented right away, or will be postponed; and 4) After all, or some, iterations have been successfully tested, the implementation will go into production. An important prerequisite for the above development process is the analysis which evaluates the feasibility of the project including a project charter.

Currently used development tool include *Subversion* for Source Code Control which the capability of team-based check-in and check-out source code including version control. Subversion is an open source initiative driven by the Apache Foundation. Another development tool includes *Bug tracking*, a *Drupal module* that is associated with a Drupal project module. For project sites, Drupal is also used. *Configuration Management* is used to move database



objects and source code from one environment to another (e.g., from development to test, test to UAT and UAT to production, is currently managed manually). *Oracle SQLDeveloper* is used for code development for database development, Eclipse and Oracle JDeveloper for Java development and Adobe FlexBuilder for Flex development.

Application development goals include Health Physics System Improvements (SHPII Phase I: SHP Replacement, and SHPII Phase II+: Self Service, Systems Integration and Other Improvements) and Software Development Process Improvements (Source Control, Bug Tracking, Configuration Management, and Project Site). Currently, the group is in the process of developing the SHP replacement which is anticipated to finish in 2012. Subsequent phases will consider implementation of the following examples: Self-service, such as online request forms, lab contact update of selected data, trainees view of their HP-related training history; Workflow to manage and track forms such as CRA update sheets, surveys, renewals, instrument pick-ups and quarterly inventories; Daily decay corrections; Additional survey types such as patient room and DOT surveys of reusable containers that go off campus; Integration with campus and EH&S databases such as STARS, LBRE building information, Person Registry; and Additional functionality to support radioactive waste management, CRA renewal, refresher training and laser management. The goal of improving the development process and tools is driven by the fact that the software development projects have increased considerable in scope, time and resources and therefore requires different methods and tools for conducting and completing an effective and efficient software project. This, in particular, would be true for the upcoming project of development a new version of ChemTracker where additional development resources would likely be needed. For this reason, this project would be required to be conducted in connection with the development of the project charter of the new ChemTracker.

ChemTracker Systems (application development)

Much of this service will follow the directions and goals of the previous section describing the application development of EH&S administrative systems. Application development goals include a new ChemTracker product for the ChemTracker Program. This entails, the following technical requirements would be instrumental in establishing a sustainable product:

Surveillance	Current ChemTracker	Future ChemTracker
Products	Two major versions including residue from ChemTracker version 2 in the Harvard implementation	One product
Version	Many versions for ChemTracker 1 and 3	One production version

Customization	Customized code for Stanford Waste tag, TSRI Audit Function, Harvard Placards, MIT Structure Search, Barcoding and possibly more	No customization with all functionality offered to all members through Configuration
Data Access	Direct data access for UNR and MIT	No direct data access
Data and Classification Tools	Microsoft Access, direct database level manipulation	Web-based tools replacing current practice

Another noticeable component of the new ChemTracker product would be the introduction of mobile technologies such as tablets and mobile phones. Therefore, it is therefore important to have developed a mobile strategy, not just for ChemTracker, but also for EH&S, which needs to be considered during the ChemTracker project charter.

Integration Services

EH&S systems integrate with the following departments across the campus: 1) Incoming (Buildings and Rooms from LBRE, Basic Person data from AS Data Warehousing, and Person data from Human Resources); 2) Outgoing (Training completion data to STARS, Training data to eProtocol, ChemTracker Chemical Use Areas to LBRE (for EH&S use), and Person data from Human Resources to Medgate); and 3) Goals (Person Registry Integration, FAMIS Integration, STARS Integration).

Administrative Systems has suggested that the Data Warehousing solution will be phased out in lieu of the Person Registry. We have the necessary technical tools and techniques to migrate the EH&S back-end processes to retrieve the basic person data from the person registry. It is likely that we would be required to formally request permission to use this data. The major benefit to EH&S of switching to this solution is that we would have easier access to additional person fields, if needed. LBRE is in the process of replacing the existing operational base-map system as well as the space management system. The current FAMIS Space Management system is running on a rather old version of the software application and support for this application will be discontinued in the near future. The project goal is to determine whether or not we should upgrade the underlying database, FAMIS Space Management, or switch to a competing product from Oracle called Property Manager. Both projects pose opportunities for EH&S to share property information. The current process of updating the STARS database with EH&S training includes a numerous areas for improvement. Over the past years, EH&S has requested methods for updating the training completion data via an Application Programming Interface (API) without any luck.

Infrastructure

Our infrastructure strategy is to utilize campus infrastructure services to the extent that it serves EH&S program interests, EHS& IT resources efficiencies and EH&S IT's customer service to its users. This goal has already lead to the migration of



MeetingMaker to Zimbra and the migration of Novel authentication to campus Active Directory authentication in addition to hosting all EH&S servers at the Forsythe hosting facility. EH&S rents three racks containing 15 servers and KVM switches. Most workstations and laptops at EH&S contains Microsoft Windows XP Professional with a varied degree of Microsoft Office 2003, 2007 and 2010. The goal is to standardize the hardware platform and in particular the operating system and Office version to Microsoft 7 Enterprise Version with Office 2010. Not only will this configuration serve the department for at least the next five years, but it will also ease the user support and ensure that the platform is supported by Microsoft. The hardware mapping is required to determine what hardware needs to be replaced. The IT group will focus a great deal on application and data security over the next two years with the end goal replacing the existing application server and database server infrastructure with a more secure and robust solution. In order to determine the appropriate level of security controls, we would need to assess the data classification in cooperation with the data owners and the University Information Security Office. The IT continuity plan will be developed with the business owners to determine what services need to be accessible during a disaster. This may involve service redundancy at the Livermore Server Facility. We anticipate to implement whole-disk encryption technologies on all EH&S laptops. Land, Buildings and Real Estate has already gone through this process and we are working with the LBRE IT group to learn from their experience.

Project and Program Support

Over the last two years, the IT group has been increasingly involved in non-technical support to EH&S programs and initiatives. This includes business analysis and QA support to the biosafety module of eProtocol and to some extent, support to the eAM project. We may anticipate an increased for such support as the department is using more advanced technology and higher integration with campus-wide systems.

Operational Services

Application Monitoring and Support

On a daily or weekly basis, IT group monitors the following list of reports in addition to monitoring the previously mentioned integration points:

Hazardous Waste Reporting. Semi-weekly reminders to the Hazardous Waste group on items that need to be picked up, Weekly report for the Hazardous Waste Group on the items picked up, Monthly summary reports for the Hazardous Waste Group

BioSafety. Weekly notifications to PIs to fill out Blue Sheets, Monthly summary reports of Blue Sheet activity to the BioSafety group, and Data transmission from SPIDERS to the BioSafety Blue Sheets system including PI notification

Health Physics. Monthly summary reports of Dosimetry activity to the Health Physics Group, and Sweep notifications, reminders and reports

Training. Daily transmission of EH&S online training records to the STARS system, Update STARS data loading status report to EH&S web site, SafetyTrain reports with evaluation scores to Training & Communications Group, and Online training statistics

Furthermore, the IT group manually supports the deletion of waste tag inventory items and assists business owners in adhoc reports.

While we anticipate that the support of the eAM application will be supported fully by Administrative Systems, we will monitor the need for OBIEE reports closely since there may be a business case for the IT group to support OBIEE eAM reports.

Website Management

The IT group addresses about four requests per week for content changes to the EH&S web site. Our goal is to work with the EH&S Communication group to establish a new EH&S web site that utilizes collaboration tools allowing content changes by non-technical staff.

Desktop Support

One FTE is allocated to desktop support. All desktop support requests are managed in Remedy which allows other IT group members to back up the FTE.

Infrastructure Support

EH&S IT manages outsourced IT Services including: Oracle Database Administration: Ntirety; Physical hosting of most EH&S servers: Stanford Information Technology Services (ITS), Linux administration of a four Linux-based EH&S servers: ITS; Server backup of a four Linux-based EH&S servers: ITS; Email and calendaring: The first-level user support is with EH&S IT, and the operations and second-level user support is with ITS; and Departmental Firewall: ITS. Infrastructure support is provided for Most EH&S network devices, Windows file servers, The majority of Linux-based application servers, A/V at the Faculty Club, EH&S A/V, Weather Station, and Back up of all Windows servers and most Linux servers.

ChemTracker Instance and Programming Support

ChemTracker Program Operational Needs include Query, database and PL/SQL programming support for the data classification group; Setting up database accounts, database structures, and applications for new ChemTracker members; Technical bug fixing; and Implementing new functionality or changes to existing functionality. One FTE is allocated.



Appendices



Appendix A

Summary of Programs

	Supports these University Units	Technical Services Provided	Business Drivers
OCCUPATIONAL HEALTH & SAFETY	<ul style="list-style-type: none"> Research Laboratories and Clinics General Workplace Settings Facilities Service Operations Construction / Renovation 	<ul style="list-style-type: none"> Biosafety Ergonomics Industrial Hygiene Laboratory Safety and Chemical Hygiene Facility Construction, Renovation, Maintenance, and Decommissioning Hazardous Materials Management Safety and Compliance Workplace Safety 	<ul style="list-style-type: none"> Assurance of a safe and healthful work environment Institutional regulatory compliance
HEALTH PHYSICS	<ul style="list-style-type: none"> Research Laboratories Stanford Hospital and Lucille Packard Children's Hospital Veterans Affairs Palo Alto Health Care System Radiochemistry facilities Research Committees Construction / Renovation 	<ul style="list-style-type: none"> Licensing, Registration, and Authorizations Administrative Panel Support Exposure Monitoring Contamination surveys / leak tests and Emergency Response Facility Plan Reviews and Decommissioning Laser Safety Human Subjects Deliveries and Shipments Training 	<ul style="list-style-type: none"> Radioactive materials research (including clinical drugs) Radioisotope production Spills and Releases Institutional regulatory compliance New Construction and Remodeling Facility Usage (including radiochemistry) Laser use
FIRE SAFETY	<ul style="list-style-type: none"> Stanford Main Campus School of Medicine Hopkins Marine Station SLAC National Accelerator Laboratory New construction and remodeling 	<ul style="list-style-type: none"> Code Compliance Plan Reviews Inspections Liaison with local jurisdictions Maintenance and Testing Remote Fire and Intrusion Alarm Monitoring Station Training Fire Investigations Special Event Planning 	<ul style="list-style-type: none"> Fire Prevention Engineering Building and Fire Codes Hazardous Materials use Annual fire safety inspections Cost of risk Multiple jurisdictions Fire-fighting service contracts Equipment failures and After-Hours response Building occupancy
ENVIRONMENTAL PROTECTION	<ul style="list-style-type: none"> Research Laboratories and Clinics Facilities Service Operations Construction / Renovation 	<ul style="list-style-type: none"> Hazardous Waste Programs Air emissions Wastewater discharge Hazardous Material Spill Prevention and Response Historical Releases Plan Reviews Sustainability Toxic Substances Control Act 	<ul style="list-style-type: none"> Environmental Protection Agency (EPA) Bay Area Quality Management District County of Santa Clara Department of Public Health Regional Water Quality Control Board



	Supports these University Units	Technical Services Provided	Business Drivers
TRAINING AND COMMUNICATIONS	<ul style="list-style-type: none"> • General Workplace Settings • Research Laboratories and Clinics • Facilities Service Operations • Construction / Renovation 	<ul style="list-style-type: none"> • Compliance Training • Three Tiers of Training • Course Delivery • Recordkeeping • Communications / Publications / Delivery of Materials 	<ul style="list-style-type: none"> • University employees • Research involving hazardous materials (bio / chem / rad) • Risk Management • Accident Investigations
EMERGENCY MANAGEMENT	<ul style="list-style-type: none"> • Public Safety • Emergency Management Steering Committee • Departments and Schools • General Workplace Settings • Research Laboratories and Clinics 	<ul style="list-style-type: none"> • Planning and Assessment • Emergency Operations Center (EOC) • Response Teams • Emergency Exercises and Preparedness Education • Mass Notification Programs • Hazard Mitigation • Business Continuity • Risk Assessments 	<ul style="list-style-type: none"> • Disaster recovery and Business Continuity • Incident Command System
CHEMTRACKER	<ul style="list-style-type: none"> • Research Laboratories and Clinics • General Workplace Settings • Facilities Service Operations • Construction / Renovation 	<ul style="list-style-type: none"> • Reference Database / Data Integrity • Regulatory Reporting • Chemical Safety Information • ChemTracker Consortium 	<ul style="list-style-type: none"> • Laboratory Standard and Hazard Communications Standard (8 CCR) • Regulatory compliance
INFORMATION TECHNOLOGY (EH&S IT)	<ul style="list-style-type: none"> • Administration • BioSafety • Hazardous Materials • Health Physics • Training 	<ul style="list-style-type: none"> • Applications (Development) • Integration Services • Infrastructure • Programming • Web Management 	<ul style="list-style-type: none"> • ChemTracker • Hazardous Waste • STARS