Environmental Health & Safety (EH&S) Programs and Services

University Units Supported

Technical Services Provided

Business Drivers

Version: December 2, 2015

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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.

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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 & Real Estate and Residential & 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 renovation 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 & Communication*** programs support general workplace settings, research laboratories and clinics, facilities service operations, and construction / renovation. ***Emergency Management*** programs support Public Safety, Emergency The Management Steering Committee, departments and schools, general workplace settings, as well as 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 include the Laboratory Standard, Hazard Communication Standard, and regulatory compliance. ***Information Technology*** 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 ten major divisions that comprise EH&S:

1. Occupational Health & Safety
2. Occupational Medicine
3. Health Physics
4. Biosafety
5. Fire Safety
6. Environmental Protection
7. Training & Communications
8. Emergency Management
9. ChemTracker
10. Information Technology

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

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Occupational Health & Safety

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

Occupational Health & Safety

The Occupational Health & Safety (OH&S) 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
• Research Laboratories and Clinics • General Workplace Settings • Facilities Service Operations • Construction / Renovation	• Ergonomics • Industrial Hygiene • Laboratory Safety and Chemical Hygiene • Facility Construction, Renovation, Maintenance, and Decommissioning • Hazardous Materials Management • Safety and Compliance • Workplace Safety	• Assurance of a safe and healthy work environment • Institutional regulatory compliance • Financial loss control including workers' compensation, regulatory penalty, legal liabilities and potential funding losses

University Units Supported

The OH&S staff is responsible for supporting 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, compliance assistance, ergonomics, hazardous materials management, and laboratory safety. Examples of common services include:

Laboratory safety training

- Safety consulting on research procedures/practices
- 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)

OH&S staff industrial hygienists provide technical management and oversight of chemical, and physical hazards in laboratories and clinics. Hazards addressed range from carcinogens, highly reactive materials, toxic gases, as well as physical hazards such as ergonomic stressors, machinery operation, etc.

Hazards addressed range from carcinogens, highly reactive materials, toxic gases and hazardous materials.

OH&S 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, 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.

General Workplace

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 OH&S 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, 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 OH&S 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, and Residential and Dining Enterprises, and critical support of new construction and remodeling projects.

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Technical Services Provided

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

Ergonomics	Industrial Hygiene	Laboratory Safety & Chemical Hygiene
• Computer Ergonomics • Laboratory Ergonomics • Material Handling • Promotion- Ergonomic Risk Reduction (Campus-wide, and targeted risk groups)	• Accident/Incident Investigation • Hazard Communication • Chemical Exposure Assessment • Respiratory Protection • Noise-- Hearing Conservation • Indoor Air Quality • Confined Space Entry • Reproductive Health Hazard Evaluation	• 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
• Hazardous Construction Material Management • Project Safety • Facility Decommissioning and Closure • Sustainability • Playground Safety	• Regulatory Reporting • Chemical Inventory Information Management • Chemical Facility Anti-Terrorism • Chemical Safety Information Services • Life Safety Box Program	• 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	• Loss Control & Risk Reduction • Slips, Trips, Falls • Lockout/Tag-out & Electrical • Fall Protection • Lift Trucks, Hoists, & Cranes • Industrial/Shop Safety

OH&S Programs are supported by highly qualified technical staff, many of which are cross-trained in multiple program areas. The technical and educational background of the group is extremely strong, including staff with advanced degrees and/or professional certifications in the following areas: Chemistry, Industrial Hygiene, Public Health, Kinesiology, Occupational Medicine, Chiropractic, Nurse Practitioners, Physician Assistant, and Medical Assistance.

Business Drivers

Establishment and effective operation of OH&S programs at Stanford is business essential. The primary institutional business drivers for OH&S 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 & Healthy 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:

- Newly Emerging and Developing Areas of Research
- Research Affiliated Security Management
- New and Existing Facilities

Newly Emerging and Developing Areas of Research

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, including the quantitative analysis of cellular regulatory systems, and the development and application of comprehensive chemical and genetic tools for perturbing and probing regulatory networks are of future interest to the program.

Translational Research

Translational research, or "bench-to-bedside" research is where 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

Anticipated areas of future OH&S program focus relating to emerging research technologies are expected to need more attention in the near future. Increased outreach, training, and guidance for the Stanford research community regarding potential hazards and safe laboratory practices will become increasingly necessary. Additional research support with provisions of protocol reviews and consults as deemed necessary by the University's Administrative Panel on Biosafety and other institutional review committees are also needed.

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.

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.

Expanding Health and Safety Coverage to New and Existing Facilities

OH&S 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. Recent expansion includes the new Science and Engineering Quad as well as expected future new Biology, Chemistry and School of Medicine buildings. In addition, expansion of research facilities off-campus is also a newer trend that has been particularly popular with research in the School of Medicine.

Abatement and Decommissioning

The improved 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.

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Program Elements

General	Ergonomics	Facilities	Hazardous Materials
• Injury & Illness Prevention Program (IIPP) • Accident / Incident / Exposure Reports • Cal/OSHA Liaison • Worker Compensation Case Management • Plans Reviews • Facility Design Guidelines (FDG) Development	• Training • Ergonomics Workstation Evaluations • Ergonomic Equipment Recommendations • Ergonomic Equipment Reimbursement Fund Program Management • Contracted Services for SLAC • Ergonomic Risk Reduction • Campus Move Assistance	• Asbestos Management • Lead Management • Facilities Decommissioning and Closure • Playground Safety • Construction Safety	• 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
• 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	• 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	• 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	• Slip / Trip / Fall Prevention • Confined Space • Forklift Safety • Ladder, Scaffolding, and Aerial Lift Safety • Compressed Air and Gases • Machinery and Power Tool Safety • Lockout / Tag-out • Vehicle Safety • Electrical Safety • Illumination • Stairs / Aisles / Walkways / Work areas / Crawl areas • Fall Protection • Crane Safety

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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, Ensure safe remodels and new construction projects.
Program Elements	Accident / Incident / Exposure Reports | Cal/OSHA Liaison | Worker Compensation Case Management | Plans Reviews | Facility Design Guidelines (FDG) Development
Business Drivers	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 OH&S Program has developed and actively maintains the University's institutional Injury and Illness Prevention Program (IIPP) to guide Stanford 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 on workplace injury and illness loss prevention. Key elements of Stanford's IIPP are described below.

Program Elements

Written Program

Per Cal/OSHA regulations, the OH&S 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.

Regulatory Driver

(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 OH&S 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)).

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 training, integration of health and safety practices into new employee job descriptions and performance appraisals, employee recognition and disciplinary actions when appropriate, 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. OH&S 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 OH&S 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 OH&S Program assists specific higher-risk departments in assessing/correcting potential hazards (for example, ongoing custodial ergonomics efforts in Student Housing) (Reference 8 CCR 3023(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 OH&S 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, examination of workplace for factors associated with the accident/exposure, determination of possible cause(s), ensuring supervisor takes corrective action to prevent incident from recurring and that supervisor records the findings and corrective actions. For serious injuries or fatalities, OH&S 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 OH&S Program provides technical assistance in implementing corrective actions (Reference 8 CCR 3203 (a)(6)).

Training

To ensure compliance with Cal/OSHA, the OH&S Program is responsible for providing 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 OH&S Program (see the section on EH&S Training).

Regulatory Driver

(Reference 8 CCR 3203(a)(7)).

Future Needs / Challenges

In addition to continued institutional maintenance of the IIPP, OH&S 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.

Program Elements

At Stanford, this process involves departmental submission of the Incident Investigation Report (SU-17). The OH&S Staff is responsible for reviewing SU-17s and initiating appropriate follow-up as needed. The OH&S Staff is responsible for evaluating SU-17s involving safety issues (i.e., slips, trips & falls), musculoskeletal sprains/strains, and exposures to chemicals, noise, etc., these three categories constitute that vast majority of the SU-17s. For other special incidents, SU-17s are appropriately triaged to the relevant program area (e.g., Biosafety, Health Physics, etc.) for specific evaluation.

Cal/OSHA Liaison

The OH&S Program typically represents the University for interactions with Cal/OSHA. OH&S plays a key role in ensuring that Cal/OSHA compliance visits are carefully expedited to ensure:

- The University continues to develop its good-faith relation w/ Cal/OSHA whenever opportunities arise
- 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). OH&S 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, 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 paperwork for a potential exposure, accident, or incident, the management of the case is protracted despite the efforts of OH&S, Risk Management, Human Resources, and Occupational Medicine Department.

One of the main factors in the complexity of a case stems from the employee's misperception of the hazard, despite a negative hazard evaluation by the Industrial Hygiene 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 when they 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 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, ACGIHANSI 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 OH&S staff will take on an even larger role in this area especially in specialty laboratory issues such as toxic gas.

Facility Design Guidelines

The Stanford Facility Design Guidelines (FDG) are guidelines and specifications, which project managers and their consultants and contractors, are to follow during remodeling and new construction projects on campus. The OH&S Program develops sections for inclusion in the FDG standards. Examples of guidelines brought forward by the OH&S 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 OH&S Program is involved in any necessary future standards development, which has health/safety elements.

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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, 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	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 repetitive activities.

Program Elements

Training

OH&S 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 via classroom-based sessions. Annually, approximately 1,200 employees complete on-line computer ergonomics training (note: this training provides a workstation self-assessment tool for employees to evaluate their workstations for potential deficiencies). Annually, OH&S 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 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:

- EH&S has further opportunity to promote the University's proactive efforts with ergonomics training and self-assessment.
- Elimination of personnel exposure to misinformation from retail salespersons.
- Personnel ability to better select equipment without the inconvenience of driving to off-campus stores or showrooms.

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 workstations, 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 this ergonomic risk reduction incentive program.

Contracted Services for SLAC

As part of an OH&S contract to provide occupational medical services at SLAC, OH&S 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 recent 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. OH&S 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.

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:

- Ergonomic evaluation of high risk processes
- Staff ergonomics training
- Consultation on workplace/ process modification(s).

For example, the Ergonomics Program facilitated interventions with the UIT Department, SU Grounds, and Student Housing. Interventions consist of ergonomic risk assessment and evaluation, discussions 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. The past several years, the program has assisted with large department moves for the Graduate School of Business, 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.

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 overall University injury risk reduction. OH&S 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. For continuing Ergonomics Program efforts, ample facilities will be required for live ergonomics training, facility should accommodate at least 36 people, and Ergonomic Products Showroom. 200 ft^2 is sufficient to house equipment and allow multiple visitors.

Stanford

Facilities Construction, Renovation, Maintenance, and Decommission

Purpose	Prevent asbestos and lead exposure, Remediate legacy construction contaminated with asbestos, lead and other regulated materials, Evaluate safety of planned or existing playgrounds.
Program Elements	Asbestos Management | Lead Management | Facilities Decommissioning and Closure Playground Safety | Construction Safety
Business Drivers	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, 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, and 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 or asbestos containing material (ACM).

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.

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 an electronic format -which is organized, accessible and readily available. A customized on-line application developed for EH&S by Stanford's Administrative Services Department enhances Recordkeeping.

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 assist 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:

- Determines which areas require posting
- Generates signs which conform to the regulatory requirements
- Posts the signs
- 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:

- A carpenter opening a wall cavity and damaging an asbestos insulated pipe riser
- 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 manages the 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 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 Building & Grounds Maintenance 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 evaluates 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 mandatory for all Building & Grounds Maintenance employees who may encounter, but are not allowed to 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. The Skills training provided 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.

Recordkeeping

Asbestos Management Program

The program maintains in 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. Quad and building number organize information and documentation related to a specific building or building area, such as inspection data and abatement records.

Supervisors

Supervisors are responsible for maintaining the following asbestos-related documentation applicable to employees under their supervision: asbestos training certificates, medical surveillance reports, and 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 & Dining Enterprises 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 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.

Industrial Contracts Office

The Program provides consultation to the Industrial 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.

Stanford

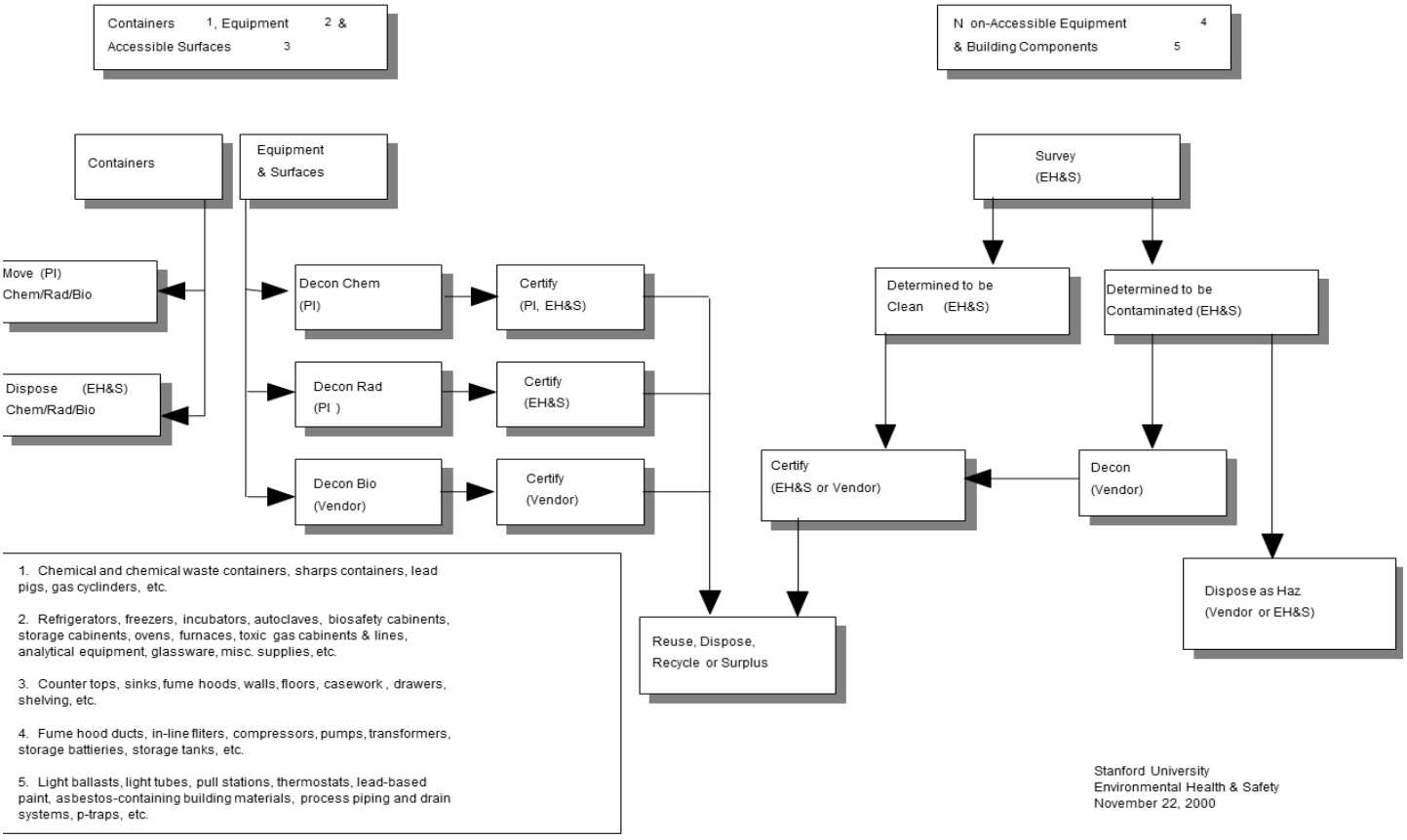
Facilities Decommissioning and Closure

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 of the physical location of the facility, permits and registration fall under either 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.

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



Facilities Decommissioning and Closure continued

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 appraised 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
- 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
- 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. PI's 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 American Society for Testing & Materials (ASTM) and the Consumer Product Safety Commission (CPSC) standards conflict with each other on many technical details, which makes simultaneous 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 repairs to existing equipment, while others such as Work Life, often replaced entire playground structures.

Program Elements

Inspections

A Certified Playground Safety Inspector, using the tools and gauges proscribed by the CPSC Guidelines and ASTM standard, must perform inspections. 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. Residential & Dining Enterprises, Faculty Staff Housing, WorkLife, and LBRE are now using the inspection reports t guide their compliance efforts. Currently, a Certified Playground Safety Inspector carries out inspections of playgrounds 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
- **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 (EH&S client), Contracts, LBRE, the landscape architect, the equipment manufacturer, and the equipment installer, with the goal of ensuring compliance with the H&S Code.

Recordkeeping

The Program maintains all inspection records and construction documents for new playgrounds. 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 and 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 Guidelines development

The Program has developed H&S related sections of the University's Facility Design Guidelines-(FDG) and maintains a seat on the FDG 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	Chemical use, regulatory reporting and permits, Department of Homeland Security (DHS)

Background

The Hazardous Materials Compliance & 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 (FacOps)

In addition to the ChemTracker services similarly provided to research groups, FacOps 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

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

The ChemTracker databases and electronic tools allow the Stanford University Fire Marshal's Office (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

Regulatory Drivers include:

- California H&S Code § 11100 – 12000, 25509, 25506, 25503.8, 25244.10, 25249.10, 25282, 44342
- SF Bay Regional Water Quality Control Board National Pollution Discharge Elimination System permit.
- County of Santa Clara Hazardous Materials Storage Ordinance
- California Labor Code § 9020
- California Public Resources Code Sections 21000-2117688 CCR § 2770.5, 3203, 85194
- California Building Code Chapter 319
  City of Palo Alto Municipal Code Chapter 13;

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 (CT) 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 Semi-Automated Matching of Names System (SAMON-ing) to link chemicals in inventories to reference data, so that regulatory reporting and billing functions of ChemTracker operate accurately. Quality control checks of the inventories are conducted. Hazardous material 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.

These submittals are 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.
- Include 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: 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 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

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 Safety Data Sheets (SDS) service are the primary means of providing this information. For certain trade products, campus chemical users may need to request SDSs directly from the chemical vendor or manufacturer.

Program Components

HMM staff provides consultation to Stanford personnel on the above databases and SDS services.

Life Safety Box Program

Regulatory Drivers

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. It 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

Laboratory personnel update inventories 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. Annually 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

The U.S. Department of Homeland Security (6 CFR 27) drives multiple elements of this program.

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.

Stanford

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	Chemical Use, Hazard Reports (including odor complaints, mold, etc.), Job Safety Analysis / Job Hazard Analysis

Background

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 OH&S Program is responsible for developing and 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, Safety Data Sheets, training, and 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 that do not leave the University, contained in stationary process containers (e.g., tanks), and transferred into and stored in another container.

Safety Data Sheets (SDS)

CAL/OSHA 8 CCR 5194(g)(8) requires that all employers make SDSs 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 SDS 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 OH&S 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, and employee rights.

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.

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.

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, OH&S 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
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. An 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 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)

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:

Section	Carcinogen
5202	Methylene Chloride
5208	Asbestos
5210	Vinyl Chloride
5211	Coke Oven Emissions
5212	1,2-Dibromo-3-Cloropropane (DBCP)
5213	Acrylonitrile
5214	Inorganic Arsenic
5215	4,4'-Methylenebis(2-Chloroaniline)
5217	Formaldehyde
5218	Benzene
5219	Ethylene Dibromide (EDB)
5220	Ethylene Oxide

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

OH&S 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 OH&S Program staff is prepared to provide support as necessary.

Personal Protective Equipment

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, Personal Protective Equipment (PPE) is used to reduce or eliminate personnel exposure to hazards.

Program Elements

Written Program

The 2015 revision of the Program is designed to advance the safety culture on campus and to fulfill the regulatory requirements of 8 CCR 3380.

A SU PPE Quick Guide is available which describes the actions supervisors and Principal Investigators/lab supervisors, or their designee, must take to implement the PPE Program in their work areas. OH&S offers other jobs aids, such as Frequency Asked Questions, to assist supervisors in understanding their responsibilities.

Hazard Assessment

To fulfill Cal/OSHA 8 CCR 3380(f), supervisors and Principal Investigators/ laboratory supervisors are required to conduct a PPE assessment to determine if hazards are present or likely to be present in the workplace that may necessitate the use of PPE. The PPE Program provides tools to document the laboratory or general workplace environment. OH&S Program staff, in conjunction with other EH&S disciplines (e.g., Biosafety and Health Physics) are available to support these workplace PPE assessments.

PPE Selection

As covered in Cal/OSHA 8 CCR 3380-3385, employers are expected to provide appropriate selection of PPE. The OH&S 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)
- 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 the manufacturer's instructions. Using guidance provided by EH&S, Supervisors provide site-specific training with Principal Investigators/ Laboratory Supervisors based on their workplace PPE assessments. This training includes when and what PPE is necessary, how to wear and adjust PPE, limitations, care, maintenance, useful life, and disposal of PPE. The OH&S Program provides PPE training upon request by shop supervisors or departments.

Future Needs / Challenges

The OH&S Program provides ongoing support of the PPE Program to assess local completion of workplace assessments and correct use of PPE.

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- OH&S 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), OH&S 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 operating procedures for respirator use
- Maintenance, inspection and repair
- Record-keeping and program assessment.

Exposure Assessment

As per Cal/OSHA 8 CCR 5144(a)(1), OH&S 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), OH&S 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
- 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. OH&S 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 OH&S 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 that 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 change out 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)

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 who are required to wear respirators must be fit-tested annually at a minimum. Exceptions include 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

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

EH&S assists supervisors in establishing written standard operating procedures (SOPs) 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 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 system. EH&S 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 OH&S Program actively maintains and evaluates the Respiratory Protection Program to meet

the Cal/OSHA regulation on respiratory protection, 8 CCR 5144.

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, OH&S 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

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. OH&S 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, OH&S 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. OH&S 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 OH&S for two years and audiograms must be retained for the time of employment. Noise hazard training is also documented and retained for at least two 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 temporarily 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 OH&S provides guidance on properly managing water damage as well as mold cleanup. 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 workday, such that both "worst case" and typical periods are likely to be sampled.

Consultation with Occupational Medicine Physician

If necessary, the OH&S 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, psycho-social 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 for which the OH&S Program provides routine support. 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, OH&S responsive support on indoor air quality concerns is essential to help prevent 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 OH&S 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 OH&S 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;
- Procedures for contacting and directing emergency services to the affected employee(s).

Future Needs / Challenges

OH&S 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- OH&S Program based on the surveillance results. The OH&S 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 OH&S 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 OH&S Program to streamline and better integrate medical surveillance with other occupational health and safety efforts.

Reproductive / Developmental Hazards

Background

Employees 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 program.

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

OH&S staff respond to questions regarding potential reproductive hazards in the work place on a case-by-case basis. With careful discretion, OH&S 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)
- Providing written recommendations

In conducting reproductive hazard consultations, the OH&S 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, OH&S 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 that 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 American National Standards Institute (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 (EHS 105). In new employee orientations and tailgate trainings provided by the supervisors, the local emergency eyewash/safety shower is identified.

Future Needs / Challenges

The OH&S 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 OH&S 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 (ERT) assesses it, and then cleans it up. For highly unusual chemical spills, the OH&S 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 OH&S staff provides technical assistance regarding the monitoring to the ERT staff. In some cases, the OH&S staff conducts the monitoring prior to the area be opened for general re-occupancy. If building occupants have any health-related questions related to the chemical spill (e.g., regarding their potential exposures, symptoms, etc.), the OH&S staff provides technical consultation. Where appropriate, the OH&S 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 OH&S 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 OH&S 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 OH&S 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
- Conducting the project after hours or on weekends

Measures for controlling dust include 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 OH&S Program.

Future Needs / Challenges

EH&S project/product review processes will be reviewed and updated as appropriate. The OH&S group intends to meet with DPM Project Managers, Building Managers and Zone Mangers 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 OH&S Program addresses their safety concerns by reviewing the proposed operation and the PPE to be worn. When appropriate, the OH&S 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 OH&S 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
- Providing on-going consultation to the supervisor to correct any deficiencies identified.

Future Needs / Challenges

Since 1993, the OH&S Program has conducted baseline surveys for the following Facilities Operations shops, 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 OH&S Program has also conducted baseline surveys for two Residential & Dining Enterprises Shops: Trades (Shop 23) and Carpenters (Shop 24). In addition, the OH&S 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), Stanford Blood Center, and Gravity Probe-B Project. The OH&S Program plans to revisit Buildings & Grounds Maintenance 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. Listed below is a basic list of current EH&S equipment.

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

Future Needs / Challenges

The OH&S 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 OH&S 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 OH&S 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.

Stanford

Laboratory Safety & Chemical Hygiene

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	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 OH&S 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 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,
- Laboratory ergonomics issues from microscopy, pipetting, animal tagging computer use, etc.

Control Measures

To control these hazards, OH&S staff provides recommendations for appropriate engineering controls, personal protective equipment use, and work practices to minimize exposures. OH&S 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 facilities meet 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
- 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 handle potentially contaminated bedding associated with hazardous waste management issues. OH&S staff examines all the potential reproductive stressors to a laboratory worker by joining forces with the laboratory staff 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 Safety Data (SDSs) 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 to researchers in a streamlined, effective manner. 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 OH&S 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 OH&S 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's (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:

- Provision of Information and Training
- Consultation on Standard Operating Procedures (SOPs)
- Exposure Assessments/Referral for Medical Monitoring
- Evaluation of Chemical Hygiene Plan
- Follow-up on Laboratory Accidents/Incidents,
- 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 graduates 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, and addressing questions during a regulatory inspection, etc.

Laboratory-Specific training, High Hazard Operations: For laboratories, EHS-133 is offered, which is 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, are 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 and 2014, sections on nanomaterials and Select Agent Toxins were 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 2015, approximately 575 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 of Standard Operating Procedures. It is provided via the Laboratory Chemical Safety Toolkit which 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 assessments
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 or an equivalent. During the review process, EH&S conducts site visits of the laboratory to better understand the protocol and to check the status of certain safety equipment, such as the location of nearest eyewash safety shower, or how chemicals are transferred. The OH&S 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 there are spills or releases of hazardous materials, OH&S 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& Compliance Program

The Safety & Compliance Assistance (SCA) Program 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 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
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 utilized by incoming faculty, and findings related to facilities issues (e.g., fume hood and hazardous waste storage area needs), which are useful for programming/ planning efforts, such as the new BioE/Chem E.

Institutional Level Assessment

In 2009, OH&S 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 is 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, Alkai metals, 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 where a particular chemical is used, thereby facilitating promulgation of the hazard information to affected groups.

Nanomaterials

Regulatory Drivers

8 CCR 5191California Health and Safety Code 57018-57020NIOSH: Proposed recommended exposure limit (REL) of 7 µg/m3for carbon nanotubes and carbon nanofibers0.3 µg/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 consultation on operations involving nanomaterials, compliance with DTSC Chemical Call-in, and 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.

Carbon Nanotubes

As part of a chemical call-in on the use of carbon nanotubes required by the Department of Toxic Substances Control (DTSC) 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 conducted a second chemical call-in for nanometals and nanometal oxides, which was 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.

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, and 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 necessitate 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.

Program Elements

The OH&S 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
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 EH&S as they are defined as "Restricted Chemicals" under the institutional Chemical Hygiene Plan http://chemtoolkit.stanford.edu/RestrictedChem. EH&S has worked with numerous compressed gas manufacturers from whom Stanford researchers acquire toxic gas, to flag EH&S for approval for purchase. This administrative control is designed to ensure that the lab is ready to receive and manage the toxic gas in a safe and compliant manner.

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 health and safety controls for toxic gas use are included, as well as checking 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 attends these inspections.

Plan Reviews

EH&S provide reviews plans consultation for new construction and renovation projects involving toxic gas use.

Information and Tools

EH&S's website provides numerous guidance documents to assist researchers considering the use of toxic gases. These documents are updated and maintained by the OH&S group in conjunction with SUFMO, including: "Stanford University required actions for regulated, exempt, and non-regulated toxic gas operations", "Stanford university's toxic gas 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".

Additionally, a specialized Standard Operating Procedure (SOP) template for Toxic Gas, prepopulated with key toxic gas controls and procedures, aids in the development of SOPs.

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 that 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)
- 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 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 facilitates journal transfers.

2. Evaluation of APLAC/IRB protocol to verify the specific types of controlled substances authorized for the researcher's review of experimental protocol with approval by the Department Chair.
3. 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 be convicted a drug felony and will report suspect drug diversions.

Start-up Lab Inspection

(CFR 1301.71, 1301.75. CFR 1304.04)
EH&S staff meet with the faculty and their 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 Stanford's Controlled Substances Binder is provided to facilitate correct recordkeeping.

Ordering / Dispensing / Disposal

(CFR 1304.21-22, 1305.05, 1305.07, 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 registration. Packages are logged into the Controlled Substances Receiving Log, and stored in the safe until pick up by the PI's 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.

EH&S Quality Assurance Visits

To assist in overall programmatic compliance, EH&S conducts periodic inspections of labs with potentially greater regulatory risk (e.g., labs using Schedule II controlled substances, 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, 2011, 2013, and 2015 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

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, enrolled faculty and authorized researchers must complete Controlled Substances web-based training (EHS-2125-WEB).

EH&S maintains 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 is $244.00, which EH&S administers. By maintaining an 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. There are currently 140 faculty enrolled. These PIs have designated their researcher staff as authorized researchers. With approximately 800 researchers now working with controlled substances, 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 a 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, 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
Short, Paralytic Alpha Conotoxins	100mg
Diacetoxyscirpenol (DAS)	1000mg
Ricin	100mg
Saxitoxin	100mg
Tetrodotoxin	100mg
T– 2 toxin	1000mg
Staphylococcal Enterotoxins (Subtypes A, B, C, D, and E)	5mg

**As of September 24th 2015, Botulinum Neurotoxin, used in a research setting, is also regulated by the Life Science Duel Use Research of Concern Oversight Policy.*

Additionally, the following Select Agent Toxins are excluded:

1. Any Select Agent Toxin that is in its naturally occurring environment provided it has not been intentionally introduced, cultivated, collected or otherwise extracted from its natural source.
2. Nonfunctional Select Agent Toxins.

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 OH&S Program provides the following services:

Inventory Screening

On a monthly basis, ChemTracker is queried for Select Agent Toxin records to find new users and to ensure they receive program documentation. As of October, 2015 there are 33 labs working with exempt quantities of select agent toxins.

Quarterly Self-Inspections

Enrolled faculty 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.

EH&S Quality Assurance Visits

Approximately once per year, EH&S visits each lab using exempt quantities of select agent toxin 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/bio-containment, 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 non-recirculating 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: development of performance and certification criterion, response to malfunctioning equipment, and 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. 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 Chem-toolkit.

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 fume-hoods) 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 to plan and review, and manage EH&S's Laboratory Standards & Design Guide.

Plan Reviews

Incoming Plans: EH&S's SUFMO office manages all the incoming plans from LBRE for both new construction and renovation, and SUFMO 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 are checked for compliance with Cal/OSHA regulations and ANSI and ASHRAE consensus standards. This includes building ventilation, fume hoods, special purpose hoods, emergency eyewash and safety showers, ergonomic issues, and roof safety, etc.

Toxic Gas Operations: If a project involves toxic gas operations, OH&S partners with SUFMO in the review process regarding requirements for gas sensors. SUFMO oversees 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 operations.

Energy Conservation Considerations: Some of these projects integrated green building concepts, which include lower air change rates, natural ventilation, and open lab layouts. As a result, the OH&S group faced some new review challenges. Because energy conservation is a paramount design consideration in laboratories, we expect to see more building designs that compete with current established laboratory ventilation methods.

Consultation/Site Visits: To facilitate understanding of the proposed programming of the space, OH&S staff collaborates closely with SUFMO staff that attends construction meetings, and as needed, obtains clarification from faculty members on the projected laboratory activities.

Documentation: Comments are provided to SUFMO for inclusion in their submittal to the project manager.

Iterative Review: Plan 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 OH&S Group has prepared EH&S *Laboratory Standards & Design Guide* to aid the campus community with planning and design of laboratories. The guide 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. OH&S is the custodian of this guide and collaborates with other EH&S disciplines, as well as LBRE 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 (CSB) completed an investigation of the Texas Tech laboratory incident involving serious injury to a graduate student. The CSB recommended 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 prepare and maintain strong and specific laboratory safety plans and that all persons in their respective laboratories should be 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. Laboratory accidents highlight the need to continue efforts 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. 575 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.

Following the 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 PPE, establishment of hazard-based SOPs, and provision of laboratory-specific training.

Therefore, in the electronic annual distribution of the Chemical Hygiene Plan in October 2010 and reiterated in 2015, Principle 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 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 their lab and the procedures, equipment, and resources available in the laboratory for working safety around these hazards.

Institutional Inspection by the DEA

With 140 enrolled faculty and nearly 800 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 OH&S 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, OH&S 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 multi-multidiscipline areas of research coupled with the ongoing turnover of laboratory personnel, 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 education around higher risk chemicals and operations is a priority.

Stanford

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	Department of Toxic Substances Control (DTSC) citations, Regulatory inspections, Hazardous materials research

Program Background

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 waste 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 (SCA) Program to better reflect the program's safety-related services that go beyond compliance.

Summary

The Safety & Compliance Assistance (SCA) Program serves the University by working directly 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 six full time exempt health and safety specialists, and one full time exempt supervisor. SCA currently provides assistance and support to approximately 2,600 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, radiation, Biosafety requirements, and waste water discharges. The program aims to 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 support specific buildings and departments to in best 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 follow-up and response, e.g., after the 2009 *UCLA tert-butyl-lithium* fire fatality and the death of a student in a Chemistry shop at Yale University in 2011.

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). Other agencies, such as the State of California Department of Toxic Substances Control and the Environmental Protection Agency, perform inspections but do not have a regular inspection frequency.

Program Elements

SCA accompanies external regulatory agencies on inspections to ensure that:

1. Many questions and issues identified by inspectors are resolved during the inspection to avoid findings being cited
2. Inspectors apply consistent interpretations of regulatory requirements. SCA staff use the same interpretations during training and safety and compliance surveys
3. New requirements and interpretations are quickly disseminated to area personnel.
4. 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 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 health and safety and 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, follow-up 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 15% 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. 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,
- Equipment: for equipment used for radioactive work which the lab plans to dispose of, or relocate.

Program Elements

1. Measure radiation and contamination levels of equipment and laboratory work areas including taking physical swipe samples.
2. 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 follow-up.
3. Process and evaluate survey swipe samples for radioactive contamination. If contamination is identified, SCA conducts immediate follow-up with the laboratory on decontamination procedures and requirements. Additionally, SCA notifies the Health Physics Program about all contamination and work practice issues in the surveyed areas. SCA maintains all survey printout records for one year.

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 to laboratories approximately 180 meters each year for the Health Physics Program. The majority of instruments are calibrated by a student

employed by the Health Physics Program with HP 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.

Laboratory group meetings to follow-up 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.

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

The following program elements are implemented: Conduct start-up inspections, order and receive drugs and precursor chemicals, coordinate pickup of drugs and precursor chemicals with enrolled researchers, and assist in biennial inspections.

Select Toxin Laboratory Inspections

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 and School of Engineering

Background

In 2004, the Department of Chemistry requested that EH&S provides 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 2014 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. A similar MOU was established for the School of Engineering, with a focus on training support.

Program Elements

The following program elements are implemented: 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. Additional laboratory walkthroughs to provide guidance and support on laboratory safety and compliance are provided. In Chemistry, the SCA staff ensures that the responsible person for each area conducts and provides documentation of self-inspections.

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. There is continuation of the trend for increased scrutiny from regulatory agencies, including Cal/OSHA and the Federal Aviation Administration.

Implementation of Bioraft, an electronic tool for PIs to manage their lab's health and safety, is currently being piloted and rolled out. This tool will enable PIs to manage many of their health and safety requirements, conduct laboratory self-inspections, among other features. Bioraft also serves as a way for EH&S to communicate findings of quality assurance visits

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	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 can include but are not limited to 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 prevents 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) requirements, the OH&S 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, OH&S 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 season or other conditions that may introduce increased risk for workplace slip/ trip/ fall, OH&S provides a reminder bulletin to building managers to inspect their facilities (per Cal/OSHA 8 CCR 3203) to minimize hazard potential.

Hazard Identification, Control, and Correction:
Per Cal/OSHA 8 CCR 3203, 3231, and 3273, supervisors and building managers 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, OH&S 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 OH&S Program provides slip/trip/fall prevention training to staff that work in areas with higher slip/trip/fall risk (e.g. dining halls, housing units). Upon request, the OH&S 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, OH&S 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 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 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 OH&S Program makes available training resources to help departments fulfill this training need as follows:

***Training*:** 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 charge of setting up and providing the training. Stanford Operating Procedures for Permit-Required Confined Space Operations is regulated 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 does 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 review of cancelled permits for thoroughness and accuracy, and a field audit to evaluate how hazards are 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 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 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 operation (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 employee's initial operation. Training is the main element required by CAL/OSHA in regards to forklift safety. The OH&S 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 OH&S involves class training and a hands-on session where operators are trained and observed operating a forklift.

The training last 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.

Refresher training is provided for forklift operators, depending on length of current certification (annual or biennial). Each individual's training records are maintained by their supervisor for a minimum of one year.

For each training, OH&S is involved in: coordinating with supervisor to ensure forklift is available and inspected prior 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 OH&S Programs 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 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/OH&SA 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 OH&S 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 OH&S 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 OH&S 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, OH&S 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 OH&S 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 OH&S Program works with department supervisors to identify training needs and help selected contracted training providers.

Future Needs

Communication Efforts. The OH&S 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, OH&S program staff 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 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. Machinery are used for the following 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 OH&S 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 OH&S Program of any necessary corrective action. As appropriate, the OH&S 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 OH&S Program. Equipment-specific training, on safe operation of machinery and power tools, is provided by the local shop management.

The OH&S 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, OH&S 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/ tagout 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/tagout 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 that 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 OH&S Program has recently developed a training program for lockout/ tagout 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 OH&S 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 OH&S 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 utilized 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 & Dining Enterprises) generally bring in speakers to train their employees on defensive driving techniques.

Golf Cart Use

OH&S 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 OH&S 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, 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 OH&S Program provides workplace hazard communications and general electrical safety training.

Program Elements

Communications

Per Cal/OSHA 8 CCR 3203 a(3), the OH&S 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. OH&S 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 employers 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 OH&S-produced IIPP/General Safety training provided basic electrical safety information. For lab and shop personnel, the OH&S Program developed general electrical safety training. Operation-specific training is be provided by the department supervisor.

Consultation

Where needed, the OH&S 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 OH&S 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, workbenches, 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. Proper lighting must meet the following requirements: proper illumination, uniform lighting, avoidance of glare, appropriate contrast, correct color, and avoidance of flicker.

Program Elements

Surveys

The OH&S 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.

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 OH&S 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 OH&S Program informs the supervisor of any necessary corrective action. As appropriate, the OH&S 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.

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 OH&S 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/OH&SA 8 CCR 3203, supervisors are required to assess potential hazards for work operations. The OH&S 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 OH&S 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 OH&S 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. OH&S developed a guidance document providing 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 OH&S Program works with department supervisors to identify training needs and help select contracted training providers.

Future Needs / Challenges

Communication Efforts: The OH&S 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 OH&S 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 Buildings and Grounds Maintenance 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 Mangers 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 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.

Stanford

University Occupational Medicine Clinic

Injury & Illness Treatment, Medical Case Management, Medical Surveillance, Travel Medicine, and Wellness & Prevention Services

The University Occupational Medicine Clinic supports the education and research mission of the University through the prevention, early detection, and treatment of occupational injuries and illness for employees throughout the University and SLAC.

Supports these University Units:	Technical Services Provided	Business Drivers
• University Employees • Research Laboratories and Clinics • Operational Units • SLAC	• Management of Industrial Injury/Illness Care – Workers' Compensation • Medical Surveillance • Medical Records Management • Medical Case Management and Return-to-Work Program support • Wellness/Prevention Services • Travel Medicine • Automatic External Defibrillator Program (medical oversight) • Medical Education/Teaching Functions.	• Assurance of a safe and healthy work environment • Institutional regulatory compliance • Workers' Compensation • Financial loss control

Stanford

University Occupational Medicine Clinic

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, and 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	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 present 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:

- Management of Industrial Injury/Illness Care – Workers' Compensation
- Medical Surveillance
- Medical Records Management
- Medical Case Management and Return-to-Work Program support
- Wellness/Prevention Services
- Travel Medicine
- Automatic External Defibrillator Program (medical oversight)
- 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 provides 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
3. Referral to a specialist when indicated. SUOHC uses a carefully selected network of specialists in Hand Surgery, Orthopedics, Spine Surgery/Neurosurgery, Psychiatry, 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 facilitate the rapid treatment of patients and to prevent 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
7. Co-morbidities 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 (WC) 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 150-200 follow-up visits per month for ongoing injury/illness care.

We currently utilize 2.7 FTE clinician time (2.0 mid-level providers and 0.7 FTE MD providers, with 80% of that time devoted to WC Injury/Illness care) to meet WC visit demand. The current clinician-staffing model does not provide for a backup physician, including when the physician is off-site for meetings and other administrative responsibilities, conferences, and vacation.

Addition of a 0.2 – 0.4 FTE MD would provide backup during these times as well as enhance SUOHC's ability to perform medical outreach and education regarding injury and illness prevention.

Cost reduction: Future cost savings are likely to be realized 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 continue to work 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 continued to observe a higher numbers of lost or restricted workday claims as well as an overall increase in net costs of both "medical only" and DART claims. SUOHC is partnering 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. In addition, EH&S and SUOHC expansion plans anticipate inclusion of on-site physical therapy and space for specialist consultation in order to reduce lost work time and enhance short- and long-term recovery by providing consistent therapeutic modalities and rehabilitation in an accessible campus location.

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 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, 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 supervisors or HR Managers to assess needs for employee medical surveillance based on physical demands and specific environment conditions and risks of a given job. This needs to be implemented for 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:

There is no consistent manner for SUOHC to know which employees require medical surveillance. 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.

A lack of a central assigning & tracking software 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 workplace exposures. For example, SUOHC does not currently receive consistent notification of employees who work with human blood/OPIM. As a result, we are unable to appropriately 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 implementing a platform as described above at Stanford University, most notably in the form of a new electronic medical record with patient and supervisor portals for access.

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 work with Risk Class 2 species, including rodents. Our new software will improve the process by the following:

1. Streamlining the LAOHP questionnaire completion and submittal process through provision of an online lab animal allergy questionnaire that can be accessed through a dedicated patient portal
2. Generating and distributing automatic completion reminders with embedded links to the LAOHP questionnaire
3. Allowing for species-specific targeting as a result of a direct RC1 and RC2 data feed from APLAC and automated flagging of positive responses to animal allergy questions
4. Providing improved supervisory oversight whereby local supervisors and EH&S gain the ability to assign this questionnaire to researchers not formally listed as RC2 on protocols but who work in areas with potential presence of animal allergens.

Offsite vendor use: SUOHC continues to assume control of surveillance programs for groups that historically performed such services offsite, most notably now managing the hearing conservation and respiratory surveillance medical examinations.

Pre-travel assessments: SUOHC currently performs pre-travel medical assessments for work-related international travel. CDC travel guidelines are followed, and necessary vaccinations and malaria prophylaxis are provided as needed. SUOHC continues to expand outreach regarding this benefit for the campus population.

Medical Surveillance: With the pending implementation of the new electronic medical record, there will be a projected increase in medical surveillance at SUOHC due to increased program inclusion and compliance fostered by improved identification and notification of the program participants, this shall require additional work by SUOHC and EH&S staff during Departmental and supervisor outreach.

Surveillance	Enrollment	Regulatory Drivers	Summary of Surveillance Components	SUOHC Observations
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 a list of all university personnel enrolled in program, nor do we regularly receive BBP declaration/declination forms. These are often maintained by the individual department
Occupational Noise - Hearing Conservation Program	CM cage washers, Grounds, Facilities, R&DE,	Title 8, California Code of Regulations, Section 5098	Baseline Medical Evaluation and Audiogram. Annual audiogram.	Facilities employees are now undergoing HCP surveillance at SUOHC rather than through an 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 ophthalmology for a 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 performed by SUOHC
HAZWOPER	EH&S personnel	Title 8, California Code of Regulations, Section 5194	Baseline and annual PE. Annual PFT Annual Screening labs	
Health Care Worker	SPECTRUM/Clinical Researchers/ 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/ Vaccination Baseline and annual TB screening, Fit testing if meets criteria	SUOHC is noting increasing volume of required med surveillance for this group
Daycare/Preschool Worker	Bing Nursery teachers and admin staff	California Senate Bill 792	TB screening at hire and q4 years, annual flu vaccination, pertussis and measles immunization	Heightened requirements commence 9/1/2016
Public Safety Police Officers		Title 8, California Code of Regulations, Section 5199	Respirator clearance and baseline PFTannual fit-testing, annual flu vaccination	Currently performing examinations and fitness for duty testing at PAMF
DOT	Facilities	49 CFR 391.41	DMV Exam (Class A&C) every 2 years, Random Drug screening	DOT exams at SUOHC, random drug testing at outside facility
LAOHP - Non-Human Primate	CM personnel, Researchers	CFR 1984a,b,cPHS Policy	Baseline medical counseling re. B-Virus. Baseline and annual TB screening, baseline measles clearance and Hepatitis B declaration completion	

Surveillance	Enrollment	Regulatory Drivers	Summary of Surveillance Components	SUOHC Observations
LAOHP – RC1 (other) **Female Sheep** **Male Sheep** **Wild Animals**	CM personnel, researchers	CFR 1984a,b,cPHS Policy	LAOHP Medical Questionnaire Baseline targeted medical exam and counseling. Baseline and annual Coxiella Titer Rabies Vaccination if indicated for at-risk contact	
LAOHP – RC2 **Rodents**	CM personnel, researchers	CFR 1984a, b, cPHS Policy	LAOHP Medical Questionnaire Medical evaluation only for those with positive screen	See allergy section below. Surveillance is currently optional for this group.
Comparative Medicine (Vet, Vet tech, Animal Care Worker, Cage Washer)	All CM personnel	CFR 1984a,b,cPHS Policy	Baseline and annual medical evaluation Baseline PFT and respirator clearance if needed, Baseline and annual TB screening with measles clearance for NHP workers Audiometry for cage washers	
Biological Agents **(Toxoplasma gondii, Schistosoma, Coxiella, Influenza, Dengue, Yellow Fever, Rabies virus, Vaccinia virus, Wild-type Polio virus, Varicella, RubeolaRubellaMTB**	Researchers	Title 8, California Code of Regulations, Sections 5192, 5199	As indicated for specific agent. Vaccination for vaccine-preventable disease	Increasing numbers of protocols are being submitted to APB for use of biological agents. Many require baseline medical surveillance at SUOHC.
Chemical Agents **(MPTPSelect Agents, Diphtheria 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	
Asbestos	None at present	Title 8, Cal Code of Regulations, Section 5208		
Allergy		CFR 1984a,b,cPHS Policy	Allergy Medical Evaluation, Baseline and as needed PFT. Respirator clearance and fit-testing, periodic evaluation	Targeted outreach an EH&S focus.
Nanomaterials	None at present	DHHS NIOSH Publication # 2013-145, April 2013		
Comparative Medicine (Vet, Vet tech, Animal Care Worker, Cage Washer)	All CM personnel	CFR 1984a,b,cPHS Policy	Baseline and annual medical evaluation, Baseline PFT and respiration clearance if needed, Baseline and annual TB screening with measles clearance for NHP workers Audiometry for cage washers	

Medical Records Management

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

SUOHC is currently transitioning from Medgate (EMR) to MIE for their Occupation Medicine Program. This is a web-based EMR with both patient and supervisor portals. 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 Help-Center 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 is actively migrating to a new EMR that will possess enhanced capabilities over its current EMR. This process will continue to be time-intensive while clinic protocols and program inclusion criteria are being re-evaluated during this integration period.

SUOHC website redesign is in process as part of a more comprehensive EH&S website revision.

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
2. Minimize the duration of absence and the resulting impact to both the employee and Stanford University due to work-related injuries and illnesses
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 continue to work 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 5000 annual influenza vaccinations to faculty and staff, retirees, and postdoctoral scholars.

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 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.

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.

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

An increasing proportion of the physician's time is spent in teaching functions, patient education, and clinical study design. This is being 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 continued to provide 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, blood-borne 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 to the right:

Program	Users
Beryllium	45
Bloodborne Pathogens	58
Crane Operators	4
EMT Health Surveillance	5
HAZWOPER	11
Hearing	114
Laser	415
Lead	36
Nanoparticle	7
Plating Shop	5
Respirator	51
Welding	8

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.

This includes periodic performance of specialized blood testing and other physical examinations every three years as well as chest x-ray imaging every five years for those who participate in this voluntary program. The nature of required medical services per 10 CFR 850 includes baseline medical evaluation and periodic 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. Section 850.34(b)(2) requires responsible employers to provide medical evaluations to beryllium workers annually, and to other beryllium-associated workers every 3 years.

Section 850.34(b)(2)(ii) requires responsible employers to provide to beryllium-associated workers a chest radiograph (X-ray) every 5 years.

Bloodborne Pathogens/EMT

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 58 employees enrolled in the Bloodborne pathogens medical surveillance program at SLAC. 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.

For the 5 trained EMTs on staff, surveillance will additionally include ensuring measles, mumps, rubella, and varicella immunity or full vaccination, completion of annual TB testing, periodic Tdap booster dosing, and annual flu vaccination. The direct costs associated with this will consist of immunization supplies and titer testing for the at-risk workforce that will request Hepatitis B and other 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 four 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 CAL/OSHA and ANSI standards as current DOE regulations do not require performance of substance abuse testing 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 11 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)
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 114 employees at SLAC enrolled in the hearing conservation program. The SLAC industrial hygiene team continues to perform personal dosimetry in an effort to better classify those employees who need to be surveilled under this guideline.

Laser

There are currently 415 total workers (274 employees/141 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. This exam is performed as a one-time clearance exam with no mandated annual requirement. The medical components of the examination include a review of ocular history, a visual acuity test, an Amsler grid test, a color vision test, and a focused dermatologic exam. 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 36 SLAC employees currently enrolled in the lead surveillance program, most namely 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's medical surveillance protocol is 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 spends significant amounts of time in an area in which nanoparticles have the potential to become dispersed in the air
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 7 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 51 employees throughout SLAC (as determined by the industrial hygienist), this surveillance group also includes 8 welders and 5 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 observed an initial steady rise in the total number of patients who presented for injury evaluation, whether industrial or non-industrial with clinic visit numbers overall stabilizing since 2013. This initial increase coincided with the enhancement of the campus ergonomic presence as referenced above and a concomitant number of delayed injury and illness cases presenting for care.

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
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)
5. 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 actively partners with BeWell, and the Arrillaga Recreation Center at SLAC regarding 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 timesaving services onsite, including blood pressure checks 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
3. At the time of separation from employment.

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 2016 focuses on strategic planning as it pertains to non-office 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 conducts large-scale construction projects and demolition as well as continues with staff relocation to new building sites.

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 continues to work closely with SU

EH&S for expanded ergonomics services and special initiatives.

Certified Professional Ergonomist (CPE) who 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.

Field Ergonomist (0.8 FTE) who 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.

Stanford

Biosafety & Biosecurity

General & Research-Specific Biosafety, Biosecurity, Animal Biosafety, Research Compliance, Laboratory Outreach, and BioEmergency Response

The Biosafety and Biosecurity Program provides support for research, education, personnel and the environment at Stanford University for all issues involving recombinant DNA, infectious agents, potentially infectious materials and community health.

Supports these University Units:	Technical Services Provided	Business Drivers
• Research Laboratories • Stanford Hospital and • Veterans Affairs Palo Alto Health Care System • Research Committees • Public Health Issues • Construction / Renovation	• Biological and r DNA Evaluations (APB) for Basic and Clinical Research • Administrative Panel on Medical Human Subjects / Stem Cell Research Oversight • Biosafety for Veteran's Administration Palo Alto Health Care System (VAPA) • General Biosafety • Biosecurity • Dual Use Research of Concern • Shipping of Dangerous Biological Materials • Incident follow up for Biological Exposures and Sharps • Occupational Health Issues for Biological • Animal Biosafety • Laboratory Animal Occupational Health Program (LAOHP) • Bioemergency Response • Lab Design and Plans Review • Biosafety Cabinets & Biowaste Compliance • Training	• Biological agents/ rDNA research (including clinical trials) • Biosecurity • Institutional regulatory compliance • Pathogen exposure • Shipping of Dangerous Goods

Stanford

Biosafety and Biosecurity

Purpose	Regulate use of biohazardous materials, Provide oversight of use of biohazardous materials for use with humans, animals or stem cells, provide outreach and oversight for Biosecurity, Address health risks associated with biological agents and with animal research, General Biosafety for Researchers, Investigate accidents, injuries, illnesses / exposures, Respond to bioemergencies and biological threats, Manage occupational health programs related to biological materials.
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 Drivers	Biohazardous materials, Molecular biology research (rDNA), Biosecurity, Clinical Gene Transfer, Animal Biosafety Level (ABSL) Shipping regulations, Occupational Exposure Control

Background

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 requirements, 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 (5th edition, 2009) (BMBL) 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* (November 2013) 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 Protocol Review

The Administrative Panel on Biosafety (APB) 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)
13. Use of human stem cells, which might require approval by the University Administrative Panel for Stem Cell Research Oversight (*NIH Guide*lines, 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
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 on in the appendix.

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 procedures in case of an incident or exposure
- 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

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)

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
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.

Proposed changes to the NIH Guidelines effecting Human Clinical Gene Transfer Review

NIH is proposing (Federal Register) that clinical protocols covered by the NIH Guidelines (human gene transfer, use of rDNA) should only be reviewed by the NIH Recombinant DNA Advisory Committee (RAC) if an institutional oversight body (such as an Institutional Review Board or an Institutional Biosafety Committee) requests review because the proposed research is sufficiently novel. These changes will occur in 2016 and will impact the amount of effort Biosafety personnel must invest in effected protocols.

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 cleanup, 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
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, and review 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
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* (November 2013) 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

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)

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.

There 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 effectiveness, if it is not shown to be effective, additional Biosafety personnel time for these reviews will be required to continue meeting these programmatic needs.

Animal Biosafety

Animal Biosafety Level (ABSL) Facilities

Background

Regulatory Policy

The *NIH Guidelines* (November 2013) 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

Background

Regulatory Policy

The *NIH Guidelines* (November 2013) 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)
- 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 severs 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

Background

Regulatory Policy

The *NIH Guidelines* (November 2013) 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 of Concern (DURC)

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 Federal Government established policy on Dual Use Research of Concern effective Sept. 2015 (United States Government Policy for Institutional Oversight of Life Sciences Dual Use Research of Concern). Institutional responsibilities includes:

- Establish and implement internal policies and practices that provide for the identification and effective oversight of DURC
- Initiate an institutional review and oversight process when a PI identifies research that involves one of the listed agents and
- Ensure that internal policies establish a mechanism for the PI to immediately refer a project to an institutional Review Entity (IRE) as soon as any of DURC criteria are met.

Biosafety conducts outreach to Faculty and Staff describing the list of agents/experiments under DURC (currently there is no work being done at Stanford University that would fall under the present regulatory guidelines). The Biosafety Manager has been delegated the Institutional Person of Contact, and a subset of the APB will serve as the IRE if needed.

Biosafety and Biosecurity Improvement

The White House released a strategy to improve safety and security at laboratories conducting infectious disease research (Oct. 2015, Federal Experts Security Advisory Panel (FESAP), Biosafety and Biosecurity Memorandum). Recommendations addressed eight categories to address, including culture of responsibility, oversight, outreach and education, applied Biosafety research, incident reporting, material accountability, inspection process, and regulations and guidelines. Implementation of these recommendations will occur starting 2016 and based on current research at Stanford are expected to bring new requirements related to Bioethics training, inventory quantification and a new OSHA Infectious Disease standard.

Future Needs / Challenges / Regulatory Trends

Implementation of the above federal recommendations will occur starting 2016 and based on current research at Stanford are expected to bring new requirements related to Bioethics training, biological agent inventory quantification and a new OSHA Infectious Disease standard.

Laboratory Animal Occupational Health Program

Background

Regulatory Policy

The Laboratory Animal Health Program (LAOHP) 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)
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 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, needle, stick 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 CenterN95 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). Additionally increased outreach to all potential LAOHP participants will be carried out by 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, ebola, etc.) 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

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

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

The program 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

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 blood-borne 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

Background

Regulatory Policy

Cal/OSHA standard (8 CCR 5199) regulates employee exposure to aerosol transmissible diseases (ATDs). The standard addresses both 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 has been created and implemented. Note that the regulatory requirements call for separate plans for Clinical and Laboratory locations (8 CCR 5199(d) and (f)).

Future Needs / Challenges / 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.

Medical Waste Management

Overview

Purpose and Scope

The purpose of the 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*:** The State of California Medical Waste Management Act, California Health and Safety Code Section 117710 require Implementation of this plan.

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 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 cleaned 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, and 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 them 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 Guideline*s (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, and 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 researchable application and experimental protocol of work, availability of personal protective equipment for 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 a BSL2 or BSL3 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 locations.

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 RequirementsABSL-2 Training (a combination of on-line material with in-person project specific training, done in coordination with the Research Animal Facility)

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. 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. Development of a hands-on Biosafety laboratory techniques training is being investigated.

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.

Stanford

Health Physics

Clinical Radiation, Ionizing Radiation, Non-Ionizing Radiation, Laser Safety, and Radioactive Drugs

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 (VAPAHCS) 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
• Research Laboratories • Stanford Health Care and Stanford Children's Health including Stanford Hospital and Lucille Packard Children's Hospital • Veterans Affairs Palo Alto Health Care System • Cyclotron/Radiochemistry facilities • Research Committees • Construction / Renovation	• Licensing, Registration, 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	• 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 Positron Emitting (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 Stanford Cancer Center has also stressed our resources. Several new use locations for both clinical and research PE isotopes are starting use at the new South Bay Cancer Center, the new Neuroscience Clinical facility and research facilities at Arastradero and Porter Drive.

There is also a potential of a second cyclotron at the Porter Drive location. The new Porter Drive location also houses additional PE isotope radiochemistry facilities. If there is not a second cyclotron at Porter Drive, then isotopes 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

Stanford has amended the current radioactive material license to allow limited commercial distribution to the VAPAHCS and PAMF. Currently, the VAPAHCS and PAMF receive their PE isotope from PETNET but that facility may be closing in 2016.

New facilities, renovations, and moves

New clinical facility designs (new Stanford and LPCH Hospitals) and remodels of Nuclear Medicine, Radiology, Cardiac Catheterization, 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 Drive and Arastradero and clinical facilities on Sherman Avenue, Redwood City and numerous locations throughout the Bay Area. 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

- Resources to support the cyclotron and increased use of PE isotopes in the research facilities, hospital, neurosciences and Cancer Centers.
- Second cyclotron at the new Porter Drive location (to reduce isotope transport)
- 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)*
• Licensing and Registration • Regulatory Affairs • Authorizations and Audits	• 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	• Dosimetry • Bioassays • Thyroid Monitoring	• Environmental monitoring (releases) • Laboratory surveys and oversight • Sealed source leak tests • Emergency Response • Instrument Calibration	• Plan Reviews • Decommissioning

Radioisotope Production	Human Subjects and Clinical Patients	Delivery and Shipments *(of Radioisotopes)*	Training	Laser Safety *(and Non-Ionizing Radiation)*
• Clinical Isotope Production • Research Isotope Production	• Human Clinical Use • Human Research Use	• Deliveries of radioactive materials • Shipments of Dangerous Goods	• Training material development • Classroom courses • Online courses	• 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	Department of Public Health and U.S. Department of Veterans Affairs, Regulatory inspections, Controlled Radiation Authorizations (CRAs)

Licensing and Registration

(Regulatory Drivers: 17 CCR 30108/205, 10 CFR 20, 30, 35, 37, 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 DPH/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 Hospital and Clinics and Lucile Packard Children's Hospital and Clinics, though the activities at the latter are encompassed by the University's license.

Regulatory Affairs

(Regulatory Drivers: 10 CFR 20 & 35, 17 CCR Licenses, H&S Code Section 115113)

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 (PI). The application is assigned to a professional level staff member who reviews the application, and makes a site visit, and meets with the PI or designated laboratory staff members. The health physicist then prepares 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 PI 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 month periods. Subsequent renewals on lower hazard non-human research projects may be done biennially (within 25 months). High hazard authorizations such as the cyclotron are reviewed within 15 months. The review process involves reviewing Health Physics monitoring/surveillance reports (see below), records of receipts, room usage, dosimetry and 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 PI 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 PIs safety program. The health physicist also asks the PI and project staff for feedback on the on Health Physics programs. The audits are documented on a hazards evaluations form that is reviewed and approved by the RSO.

These hazard 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 PI 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 PI 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 physicist 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	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 Administrative Panel on Human Subjects in Medical Research (of which the RSO is an ex officio member), the Administrative Panel on Laboratory Animal Care of, 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

The 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 (including the South Bay Cancer Center, the Stanford Neuroscience Health Center etc.) 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

The Non-Human use Radiation Safety Committee (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

Professional staff are 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 physician member 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	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 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. to a contact of each authorization. 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 waste 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	Radioactive materials use, Radioiodine use, Radioactive spills or releases

Dosimetry

(Regulatory Driver: 10 CFR 20Licenses, Univ. Policies)
State and federal regulations and the licenses issued by regulatory agencies define the monitoring requirements for 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 at appropriate frequencies (e.g. monthly, quarterly) 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 comparison group 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	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: 17CCR3027510CFR20)
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 for the cyclotron and other greater than 250 kvp 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 Safety Compliance Assistance Program (SCA). 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 PI, requiring written response to the APRS or LCC. Subsequent steps include requiring committee hearings with the PI, 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 provide instruments, standardized procedures and training for SCA staff. Periodically a health physicist accompanies the SCA team members during surveys to ensure uniformity and quality in the program.

Sealed Source Leak Tests

(Regulatory Driver: 17CCR30275Licenses)
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 physics 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: JCAHOUniv. 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 ± 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	New Construction and 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 all of Stanford's Hospitals and Clinics, 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 SCA 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 SCA 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	Commercial distribution of radioisotopes, Molecular Imaging, Radiochemistry facility use

Molecular Imaging Program at Stanford Cyclotron and Radiochemistry Facility

(Regulatory Drivers: 10 CFR 20Licenses, Univ. Policies)

The 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 O15. The radiochemistry facility uses the various isotopes and other PE isotopes delivered from outside facilities to produce various imaging drugs.

The Clark facilities house an animal PET scanner, shielded animal injection tables. The Lucas Expansion Building houses radiopharmaceutical hot cells (heavily shielded allowing remote manipulation) and preparation areas for both research and clinical production as well as a 16 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 have amended our radioactive material license with the RHB to allow commercial distribution of clinical and research isotopes off campus to non-Stanford clinical facilities. Additionally, isotopes will be delivered to the South Bay Cancer Center, the Stanford Neuroscience Health Center, and other clinics that may be added in the next 5 years. This production increase will continue to add to 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, O15 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.

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	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 document 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 professional staff provides shielding design recommendations, performs shielding analysis and shielding approval surveys for new facilities, new x-ray installations and equipment upgrades throughout the medical centers including PET/CT, CT, Linear Accelerators, and Fluoroscopic rooms in Radiology, Cardiac Cathology, Radiation Oncology and Nuclear Medicine.

Clinical use of CT and X-ray machines

The medical use of ionizing imaging techniques has been substantially increased in recent years, especially in Computed Tomography (CT). Our medical physics team manage the quality assurance of over 250 x-ray machines and 22 CT scanners at Stanford Hospital and VA Palo Alto hospital. The team is supervised by a Ph.D. medical physicist, who holds the certification from American Board of Radiology in Diagnostic Medical Physics. The scope of our work includes two main categories: Regulatory compliance and Quality improvement.

Regulatory compliance: because of the high radiation dose to patients and complexity of the imaging technology, the use of CT is under strict regulation of CA State Law, Joint Commission (JC), and American College of Radiology (ACR) accreditation requirements. Per JC and ACR requirements, our team performs comprehensive annual physics testing of all CT scanners to ensure both diagnostic imaging quality and patient safety.

In addition, the medical physicist designs the daily and weekly quality control (QC) program, trains the CT technologists on the QC program, and provides responsive guidance in scenario when the CT scanner performance falls out of acceptable range. Per CA State Law, the medical physicist provides patient dose estimation in CT exams that could potentially lead to overexposure of the patient. Per JC requirements, the medical physicist participates in the management and review of all CT protocols (over 100 protocols per CT scanner) used at Stanford and VA hospitals.

Quality improvement: the technology of CT has fast developed in past decades and at an elite academic medical center like Stanford with strong focus on research and teaching, there are increasing needs in utilizing latest CT technology which is not even well understood the in radiology community, and educating residents, fellows, and CT technologists on CT practice for best patient care.

With the expertise in CT physics, our medical physicist works with Stanford faculty radiologists to optimize the CT imaging techniques for a variety of clinical applications. Especially, we closely work with LPCH physicians on reducing radiation dose to pediatric patients during CT exams. The public concern over medical ionizing radiation has increased drastically in recent years.

To better manage the patient dose, the medical physicist works with hospital IT department to implement a dose monitoring program that record radiation dose of every CT exam. On a monthly basis, the physicist reviews the dose statistics of all CT exams and investigates the exams that exceed expected dose range.

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. As needed for research therapy doses, 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 PIs 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	Radioactive materials use, Veterans Affairs projects, Radioactive materials shipments

Deliveries

(Regulatory Drivers: 10 CFR 20:190649 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, and offsite research facilities such as the Stanford Research Park at Porter Drive Campus or the Stanford Prevention Research Center at Arastradero. 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	Personnel exposure (potential), New users, Radiation producing machine use

Training

(Regulatory Drivers: 17 CCR 3025510 CFR 198 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 participation in person as lecturers are offered in the form of 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). The eight hour course has recently moved to an online version that is currently in acceptance testing. There is also training by examination for users of 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.

Stanford

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	Laser Use, Ultraviolet, Infrared, and Electromagnetic radiation use, ANSI Standards

Laser Safety

(Regulatory Driver: Univ. Policy8 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, and 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.

Stanford

Fire Safety

Code Compliance & Development, Inspections, Laboratory Safety, Liaison, Fire Protection Systems, Fire Alarms, Fire Investigations, Plan Reviews, and Training

The primary goals of the Stanford University Fire Marshal's Office (SUFMO) 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 Units:	Technical Services Provided	Business Drivers
• Stanford Main Campus • Lands, Buildings, Real Estate (LBRE) • School of Medicine • Hopkins Marine Station • SLAC National Accelerator Laboratory • New construction and remodeling	• Capital Projects • Alternate Materials & Methods • Code Compliance • Capital Projects Plan Review • Inspections • Chemical Inventory Analysis • Lower Explosion Limit (LEL) Calculations • Liaison with local jurisdictions • Maintenance and Testing • Remote Fire Alarm and Security Supervising Station • Training • Fire Investigations • Special Event & Student Party Oversight • International Building and Fire Code Development	• Fire Protection Engineering • International Fire and Building Codes • Safety Culture • Hazardous Materials use and storage • Annual fire safety inspections • Cost of risk • Multiple jurisdictions • Fire-fighting service contracts • Equipment troubles and After-Hours response • Building occupancy permits

Program Elements

Overview

Capital Projects	Code Compliance	Alternative Materials and Methods	Capital Projects Plan Review *(New Construction and Renovation)*	Laboratory Safety
1. Construction Activities 2. Technical Support Services	1. Code interpretation and Analysis 2. Plans Review 3. Alternative Materials and Methods Proposals 4. Field Inspections	1. Building Use and Research 2. Construction Cost Reduction	1. Architectural Drawings 2. Automatic Fire Sprinkler Drawings 3. Alternative Automatic Fire Extinguishing System Drawings 4. Fire Alarm Drawing 5. TGO Systems 6. Access Control Systems 7. Smoke Control Systems	1. Laboratory SOP Review 2. LEL Calculations 3. Chemical Inventory Analysis 4. Annual Building Inspections 5. Fire Investigation

Chemical Inventory Analysis	Lower Explosion Limit (LEL) Calculations	Inspections	Maintenance & Testing Fire Protection & Alarm Systems	Supervising Station *(Remote Fire Alarm and Security)*
1. Control Areas 2. Building Occupancy 3. Special Hazards and Engineering Controls	1. Fume Hood Exhaust Vapor Concentrations 2. Fume Hood Maximum Use Quantities 3. Fume Hood Minimum Exhaust set points	1. Fire Safety Self-Inspections 2. Insurance Surveys 3. Acceptance testing for fire alarms, fire sprinklers, toxic gas and smoke control systems	1. Work Orders & Test Sheets 2. Troubleshooting, Repair, and Replacement 3. Building Occupant Notifications 4. Visual Inspections and Functional Testing 5. Equipment Calibration	1. Wireless radio transceivers 2. Servers 3. Head-End Equipment 4. Manitou System 5. Building Alarm accounts 6. System tests and resets 7. Troubleshooting 8. Alarm and Signal Traffic 9. Palo Alto 911 Center 10. Real-Time Alarm Notifications to BGM and R&DE

Liaison *(Local Jurisdictions)*	Training	Fire Investigations	Special Event & Student Party Oversight	International Building and Fire Code Development
1. Fire Department Access 2. Code compliance issue resolution 3. Joint inspections and Fire Protection System Acceptance Tests 4. Fire-related Emergency Response investigations and reports	1. New Student Safety training (Fire Safety) 2. School and Department training 3. Student Party Planning Workshops 4. Graduate Housing and Undergraduate Housing 5. Building evacuation drills 6. Hands-On Fire Extinguisher Use	1. Palo Alto Dispatch Center (PADC) 2. Laboratory and Housing fire incidents 3. Fire protection system functionality 4. Emergency response issues	1. Event Planning & Inspections 2. Student Party Inspections	1. Santa Clara County-wide local amendments to the new California Fire Code. 2. IFC Chapter 38, "Higher Institution Laboratories" committee 3. Model Code and State Fire Marshal amendments

Capital Projects

The University Fire Marshal's Office provides a variety of technical support services to Capital Projects managed by LBRE and other departments including Residential & Dining Enterprises (R&DE) throughout all phases of design and construction. These support services include ASA Review, Code Compliance Consultation, Plan Review, Systems Acceptances, Final Inspections, and negotiation with jurisdictions on code compliance issues to avert erroneous code interpretations that would otherwise increase

construction costs and generate undue constraints to research.

The most active group supporting Capital Projects within the University Fire Marshal's Office are the Fire Protection Engineers (FPE). Currently there are three FPEs on staff who are 100% FTEs. The fourth FPE position has been vacant since June 1st, 2015 though human resources have been actively seeking a replacement. However, even with four FPEs customer service is compromised due to the increased workload much of which is attributed to the increased construction activities.

An additional, fully funded, FPE position is required to adequately support the planned construction activities.

Code Compliance

Background

Stanford University is subject to State regulations which include Title 19, the Public Safety Code, Title 24, the California Building Standards Code, and Title 8, Elevator Safety Orders. Title 24 is further divided into 12 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 protection engineering practices. Additionally, local jurisdictions such as Santa Clara County and City of 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 (BGM), Student Housing and Residential and Dining Enterprise (R&DE), Athletics Department, School of Medicine, School of Engineering, School of Humanities & Sciences, Independent Labs, Office of Risk Management, and 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 Alternative Materials and Methods 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 are some examples of significant risks that have been addressed:

Fire Sprinkler Retrofit in Science Buildings. There were science buildings 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. Also, the Durand Building is nearing completion of sprinkler retrofit. In addition, since 2012, four mid-rise Graduate student residences (Barnes, Abrams, Hulme, and McFarland) have been retrofitted with sprinklers.

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. The California Mechanical Code for all natural gas supply lines now requires these valves in new buildings.

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 20,000 ft^3, which essentially included all Stanford 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 has been resolved.

Elevator shunt trip: On an 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 became effective 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 2016 CBC and CFC will become effective on January 1, 2017. It will be important for University Fire Marshal staff to become familiar with the differences between the 2016 codes and the 2013 codes.

Alternative Materials and Methods

The University Fire Marshal's Office proposes Alternative Material and Methods (AMM) as appropriate to comply with the intent of the code

instead of the letter of the code, which may be unduly restrictive and cost prohibitive. For example flammable liquids were allowed to be used, but not stored in basements though use is inherently more hazardous than storage. The University Fire Marshal's Office successfully negotiated an AMM with the jurisdiction to allow storage in basements. This improves safety, as researchers no longer have to transport flammable liquids between floors. In addition, an AMM can achieve construction cost reduction by using less costly materials. For example in laboratory buildings, fire resistant duct wrap has been used in lieu of a horizontal fire rated exhaust duct shaft.

Capital Projects Plan Review New Construction and Renovation

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 project completion and building occupancy. The internal technical review has an acknowledged benefit to the Capital 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, means of egress, 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: review of Alternative Automatic Fire Extinguisher System, Toxic Gas Ordinance (TGO) System, Access Control System, and Smoke Control System drawings.

Laboratory Safety

Standard Operating Procedure (SOP)

A Standard Operating Procedure is a set of step-by-step instructions to achieve a predictable, standardized, desired result.

The University Fire Marshal's Office, in collaboration with the Occupational Health and Safety program, conducts review of SOPs focusing on use of hazardous

materials regulated by the California Fire Code. This ensures the proposed experimental set-up by researchers presents minimal fire and health risks to the laboratory occupants and the building. In addition the review contributes to overall institutional compliance with codes and regulations.

Other Services

Other services including Lower Explosion Limit (LEL) calculations, Chemical Inventory Analysis, Annual Building Inspections, and Fire Investigations are addressed in their respective sections of this document.

Chemical Inventory Analysis

The University Fire Marshal's Office performs a Chemical Inventory Analysis in order to ensure the quantities of hazardous materials are within Maximum Allowable Quantities (MAQ) for each Control Area. A control area is a space bounded by not less than 1-hour rated construction. This analysis also determines the occupancy types within the laboratory building and the associated specific engineering controls as required by the California Fire Code. The analysis also determines the number of controls areas needed to meet the operational needs of the researchers. All jurisdictions require a Chemical Inventory Analysis as part of the building permit process for laboratory construction projects.

Lower Explosion Limits Calculations

The University Fire Marshal's Office performs Lower Explosion Limits (LEL) calculations to determine the solvent vapor concentrations within the fume hood exhaust ducts. Where the concentration exceeds 25% of the LEL of the solvent being analyzed a number of code requirements apply including installing fire sprinklers within the exhaust ducts, and restricting the exhaust duct routing directly outside the building and designing ducting to withstand deflagration pressures. The calculations are based on an accidental spill scenario covering the entire work surface of the fume hood. In order to limit vapor concentrations to no more than 25%, maximum use quantities are established for the highly volatile solvents.

For fume hoods using variable air volume exhaust, minimum set points may be too low to maintain vapor concentrations to 25% or less. Calculations are performed to establish higher set points to limit vapor concentrations.

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 existing buildings regulated under the California Code of Regulations, Title 19.

Initially the County's inspections were limited to the facilities operated by Residential & Dining Enterprise. 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 and again July 2015 with the County devoting 0.75 full-time Deputy Fire Marshal conducting inspections at Stanford. In April of 1999, Stanford submitted to the Santa County Fire Marshal's Office a proposal to establish a Self-Inspection Program. The 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 biennial 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 to yearly for the ones that historically present more violations is recommended to provide closer oversight. This will require additional staff.

Compliance Issues and Regulations

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

In order for the University Fire Marshal's Office to inspect yearly the non-laboratory buildings that historically present more violations, additional staff will be required.

Insurance Surveys

Background

Representatives of XL Insurance, property insurance carrier and Marsh Risk and Insurance Services, insurance broker, conduct insurance surveys annually. The surveys focus primarily on fire exposures and reliability of fire suppression systems. Buildings with high value content or replacement cost such as libraries, Allen Building and Cantor Arts are visited annually, along with buildings that have high business interruption potential such as Central Energy Facility

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 nine 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 that 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

With the increased construction of high valued buildings such as Shriram, Lathrop Library, and McMurtry Art History, 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 code compliance and fire department access issues. The importance of this role is compounded by the fact that the Stanford campus is under two major jurisdictions: Santa Clara County and City of Palo Alto. Also, the Office of Statewide Health Planning and Development (OSHPD) has jurisdiction over the School of Medicine facility located in the Stone Complex. Moreover, Palo Alto Fire Department, by a contractual agreement with Stanford, provides emergency services to the University.

The University Fire Marshal's Office works in concert with the multiple jurisdictions to achieve consistency in code interpretation and enforcement.

Key Activities

Key activities include interface with Palo Alto Fire Department (PAFD) and Santa Clara County (SCC) on code compliance and fire department access issues, conduct joint inspections and fire protection system acceptance tests, follow up with PAFD and SCC to abate deficiencies noted during annual building inspections, respond to fire incidents and work with PAFD to investigate the cause of the fire to minimize recurrence of similar incidents, and pick up PAFD incident reports and distribute to the appropriate departments including Zone Management and Residential and Dining Enterprise.

Trends

The University's Planning Office, Department of Project Management, School of Medicine, Residential & Dining Enterprise, and other departments have been forwarding fire safety and code compliance issues through the University Fire Marshal's Office for resolution with the local jurisdictions. This provides a single point of contact between the jurisdictions and the University to resolve these issues. The University Fire Marshal's Office will continue to assume this role.

Maintenance and Testing of 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 landline phones, and contacted directly from the supervising 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 (MS Outlook) from Stanford Email, for each building at intervals as prescribed by Title 19, California Code of Regulations (CCR) for fire sprinkler systems and fire extinguishers, and NFPA 72 for fire alarm systems. 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 calendar work notices, 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 projects which include: completing full system acceptance test for all fire alarm systems

with 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.

Additionally, with fire alarm systems being 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 operations (include research) and occupants. NFPA 72 now provides standards on new types of signaling systems not previously addressed (prior to 2010 edition). A few of these are: In-building Mass Notification, Wide-Area Mass Notification, Emergency In-Building Communication Systems (includes Emergency Responder Radio Systems)

The latter system is now required in all new 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 is 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 and alarm 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 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 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 a significant amount of additional tasks; follow up, recordkeeping and overall inspection time.

Future Needs / Challenges

The continued, increasing 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.

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 460 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 over 390 buildings with fire sprinkler systems that 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, Hopkins Marine Station, Stanford Auxiliary Library III in Livermore, Newark Warehouse in Newark, Provost House in Menlo Park, and SLAC Guest House.

Fire Extinguishers

There are over 9,350 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 Alarm and Security Supervising 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 Supervising 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 security such as Cantor Arts, EH&S, Packard Engineering, and Cantor Arts. The fire alarm and sprinkler system, and security alarms are monitored constantly to ensure proper operation of the systems, and timely fire and police department response to emergencies.

The remote supervising station (aka, monitoring station) consists of automation software and computer hardware (aka "Manitou") that is networked between the ESF Facility at Building C to the 911 Palo Alto Dispatch Center (PADC). The monitoring equipment at ESF Facility Building C consists of the following: computer servers, network equipment, database files, various receivers, data transmission lines, antenna's and 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. These signals are transmitted using a dedicated T1 data line connection to a workstation at PADC and to the networked EH&S Building C workstations. The PADC 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 transmission from EH&S Building C.

Key Activities

Operation of the remote alarm supervising station involves: maintaining the various severs, 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 tester-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 supervising station 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 supervising station 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 building with sprinklers enabled, 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 2013 California Fire Code Section 903.4.1 requires that all buildings (with few exceptions) send monitoring signals automatically to an approved supervising station.

Future Needs / Challenges

To reduce the risk of delayed fire and police response should ESF Building C be significantly damaged, provision of redundant supervising station equipment at a separate facility on campus would allow for continued fire alarm and security signal monitoring and transmission to PADC while Building C is being restored.

Wireless Radio Transmission

There are over 330 wireless radio units installed throughout campus. This was a result of a four-year upgrade project and new units are installed in newly constructed buildings. 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.

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. Student Party Oversight (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 conducts 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 Chapter 35. 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.

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 incidents in Laboratories University Fire Marshal staff will investigate for cause many times partnering with other EH&S groups to publish a "Lessons Learned" document distributed to the associated Laboratory personnel and the University Safety Partners. 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. All fire incidents are recorded in a database maintained by the University Fire Marshal's Office.

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, emphasis will be made during fire safety training presentations on the cause of fires and preventive measures.

Special Events & Student Party Oversight

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&S\Fire Safety web page (sufmo.stanford.edu). 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.

Special Events: 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 Cow-a-bunga 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 Inspection 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 66 is invited to attend the pre-party inspection.

Future Needs / 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 Guidelines (FDG)

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 reviews and develops 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. This also includes collaborating with other EH S programs in developing the Laboratory Design Guideline.

The FDG Committee meets on an annual cycle to review and approve new and updated FDG documents. All new and updated FDG documents are published for use in February or March of each year. Maps and Record coordinates the document submittals and publishes the approved documents online (fdg.stanford.edu)

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.

Risks and Mitigations

Conformance to the fire protection specifications and guidelines ensure consistency of the equipment

installed and 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.

International Building and Fire 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 participates in the development of Santa Clara County-wide local amendments to the new California Fire Code.

University Fire Marshal staff also participates in the International Fire Code (IFC & IFB) committee to develop the new Chapter 38 for "Higher Institution Laboratories" which will be adopted as part of the 2018 International Building and Fire Codes. Furthermore, changes to the model codes (IBC & IFC) as well as California State Fire Marshal amendments are submitted as needed to address code issues that adversely impact Universities without compromising safety.

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 equipment. These codes, once adopted, may have adverse effects to health and safety. The proposed Santa Clara County wide local amendment to the 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 stakeholders 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.

Stanford

Environmental Protection

Air Emissions, Hazardous Material Spills, Sustainability, Hazardous Waste Management, and Wastewater Discharge

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. These agencies include the Department of Toxic Substance Control, Bay Area Air Quality Management Board, Country of Santa Clara Department of Environmental Health, and the Regional Water Quality Control Board. The Environmental Management Program (EPP) reviews regulations, determines the applicable requirements, implements activities needed to provide critical services while protecting the environment and maintaining compliance. In addition EPP provides written and verbal comments to agencies when proposed regulations may impact Stanford. .

Supports these University Units:	Technical Services Provided	Business Drivers
• Research Laboratories and Clinics • Facilities Service Operations • Construction / Renovation	• Hazardous Waste • Air emissions • Wastewater discharge • Hazardous Material Spill Prevention and Response • Historical Releases • Plan Reviews • Sustainability • Toxic Substances Control Act	• 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*
1. Training 2. Identification and characterization 3. Container labeling 4. Accumulation 5. Container pick-ups & lab cleanouts 6. Environmental Safety Facility (ESF) compliance requirements 7. Chemical hazardous waste storage and disposal) 8. Surplus chemicals redistribution 9. Radioactive waste storage & disposal 10. Universal waste storage and disposal/recycling 11. Minimization of long-term liability 12. Waste minimization planning 13. Regulatory review and advocacy	1. Source permitting 2. Source compliance 3. Risk assessment	1. Waste management 2. Spill prevention 3. Hazardous materials response 4. Permits

Hazardous Material *Spill Prevention & Response*	Historical Releases	Plan Reviews	Sustainability
1. Hazardous Materials Response Team 2. Training 3. Release reporting 4. Toxic gas response plan 5. Spill Prevention Control and Countermeasures (SPCC) Plan	1. Risk evaluation 2. Remediation activities 3. Closure plan 4. RCRA Facility Assessment	1. Hazardous materials or environmental issue identification 2. Regulatory impact evaluation 3. Mitigation strategies	1. Surplus Chemicals 2. Food waste composting pilot program

Hazardous Waste

Introduction

The goal of the Hazardous Waste Program (HWP) at Stanford is to serve the community by compliantly managing hazardous wastes thereby protecting human health and the environment while efficiently supporting the teaching, learning, research, and non-research activities of the university. The Program accomplishes these goals by reducing administrative impact while effectively managing wastes in a fashion that adheres to all applicable laws and regulations so that long-term liability is minimized.

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. ***On-site Waste Transportation*** – safe and environmentally protective 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, moves, and general maintenance.
5. ***Patient Room Clearance and Surveys*** - providing clearance to allow room cleaning and re-occupancy by conducting 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.
10. ***Universal Waste Management*** - HWP manages a variety of Universal wastes such as fluorescent tubes, batteries, and electronic waste for shops and other non-lab generators
11. ***Off-Site Disposal of Hazardous Wastes*** - HWP packages and ships all hazardous wastes from four primary off site location 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 and acts as liaison for first responders called to larger emergency responses.
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 CFR20.1101(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. 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 http://nonhazardouswaste.stanford.edu.

2. ***Unknown Materials*** – Occasionally chemical containers or vessels will be unlabeled in labs 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 two 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 multi-part 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 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 one of two on line request systems to initiate the pickup of research and academics generated chemical waste: the on-line WasteTag system and the online WastePickup system. The Oracle based eAm system, is 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 9 months old.

Chemical Waste Blanket Requests

Blanket requests are 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 on-campus 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. Prior occupants of the space work with the CWP crew to assure that any deadlines are met and that materials left unmarked or labeled.

Off-site (Satellite) Container Pickups

The EPP has implemented a pilot program for routine chemical waste pickups at select off-campus satellite locations. Periodic waste pickup sweeps are made at designated lab waste storage locations in these buildings. This program has both reduced lab waste administration burdens and increased container compliance oversight.

Future Needs / Challenges

Lab Cleanout workload is highly variable. Except in the case of known building remodel or demolition work, it is also largely unpredictable. Accordingly, EPP must supplement regular staff resources with contractors up to 12 times per year. 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 not 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 occasions, a note to that effect is left with the container describing why it could not be transported and providing contact information. Additional labor would be essential for any off-site (satellite) container pickup program expansion.

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. We have repurposed an older and smaller vehicle for use in waste pickups. It will require replacement in 3-5 years.

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”. The cells are specifically designed to meet applicable safety and chemical storage standards. 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), preventing or containing all releases, and 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 centralized facility (ESF) within 90 days and from the University within one year of generation. 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 two 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 adjacent to 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 is needed. The software will be used to: log waste chemicals into the ESF, and comply with administrative requirements associated with packing into “lab-packs”. The current system generates lab-pack container inventory sheets, obtains shipping approval from disposal sites, and generates all shipment-related paperwork. The goal would be to link the two systems.

Space Requirements

The space utilized for managing chemical hazardous waste is divided into four types: temporary accumulation in the “cells”, lab-packing, moving chemical waste containers around on the dock, and vehicle loading and unloading. The “cells” and lab-pack 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 Packaging and Shipping

Background

(Regulatory driver: 22 CCR 66262.20 thru 66262.45)
Chemical hazardous waste regulations include a wide range of packaging, transportation, 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. Chemical waste containers are stored at ESF until they can be prepared for shipment to permitted, off-site, recycling, treatment, or disposal facilities. 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 construction and site remediation generated wastes are typically collected in drums by the generator, and those drums are managed without repackaging.

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 facility are chosen from list pop-ups. The computer program uses this information to determine 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

Three of the most difficult wastes to dispose of are gas cylinders, water-reactive/pyrophoric chemicals, and peroxide forming materials. Whenever possible, CWP has instructed users 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. EH&S 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 in 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”, lab-packing, moving chemical waste containers around on the dock, and vehicle loading and unloading. The “cells” and lab-packing 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 room in the ESF Annex that is equipped with lighting, fire suppression, and secondary containment.

Future Needs / Challenges

Additional administrative support as well as additional chemical storage space are needed in order to expand the Surplus Chemical Program.

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 the main isotope 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 square feet. 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 are 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 to 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, additional monitoring including entrance meters at each door way would provide added assurance that no contamination leaves the area.

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 drop-off 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 drop off locations on campus for disposal of small electronic devices (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, contractors service each location. The batteries and small electronic wastes are consolidated and

transported to the Environmental Safety Facility for segregation prior to disposal.

Packaging of Batteries - Per Department of Transportation (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 non-alkaline 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 - EPP Contractors collect small electronics from the consolidation points and transports them to the ESF. These items are consolidated and delivered periodically to the Surplus Property Store for future evaluation. If an item is not deemed reusable or resalable, it is repackaged for shipment to an authorized electronic waste recycler.

Space Requirements - The current battery processing area is approximately 15' X 15'. The interim staging area for other universal wastes awaiting shipment is approximately 10' X 10'. 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

Approximately 100 sq. ft. of uncovered space is currently used for unloading and staging various Universal Wastes. 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 Haz-Mat 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.

HWP has promoted the recycling feature of ChemTracker, the Stanford Chemical Inventory Management 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

The chemical redistribution program is limited by sporadic labor / administrative availability and limited storage space. In order to expand the Surplus Chemical Redistribution Program, additional administrative support and chemical storage space will be 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 November 2001.

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 and in many ways are considered a model. 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.

Stanford

Training & Communications

Policy & Regulations, Publications, and Recordkeeping

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
• General Workplace Settings • Research Laboratories and Clinics • Facilities Service Operations • Construction / Renovation	• Compliance Training • Three Tiers of Training • Course Delivery • Recordkeeping • Communications • Publications • Delivery of Materials	• 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
• OSHA Regulations • California DTSC • Department of Transportation • Radiation Safety / Nuclear Regulatory Commission	• Tier I: General Safety • Tier II: Site Specific • Tier III: Hazard Specific	• New Employees • Faculty • Record Keeping	• Distribution of Materials • Stanford's IIPP Support • University Safety Partner Network • Accident Follow-up System and Liaison Work with Risk Management • Website redesign

Background

The EH&S Training & Communications team strives to move from providing EH&S technical information in useful and effective formats to facilitating and affecting measurable change in the overall culture of safety at Stanford University. Recent projects sponsored by EH&S have sought to develop a repeatable process for identifying and measuring specific components that makes up the existing culture of safety at Stanford.

The EH&S Training & Communications team seeks to leverage that knowledge along with advances realized through the re-design of the EH&S website to create new initiatives that will have a measurable impact on improving safety at Stanford. The Stanford Culture of Safety initiative will be the focus of the Training & Communications team for the next several years as the website expands to become a full-fledged Stanford Safety Information Service delivering useful, timely safety related information to clients when, where and how they need it most.

One fundamental reason for providing training is accident prevention. However, environmental health and safety training is also mandated by a variety of federal and state laws, and regulations impacting a wide range 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 explicitly detailed. External/regulatory forces that drive the need for training include:

Compliance Training

Occupational Safety and Health Administration Regulations

The Injury and Illness Prevention Program

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 over-arching 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 or when their job responsibilities change thereby introducing a new hazard.

Failure to implement the requirements of the IIPP has been a frequently cited OSHA violation throughout the state of 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 / tag-out, 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 specialized 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 start date.

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.

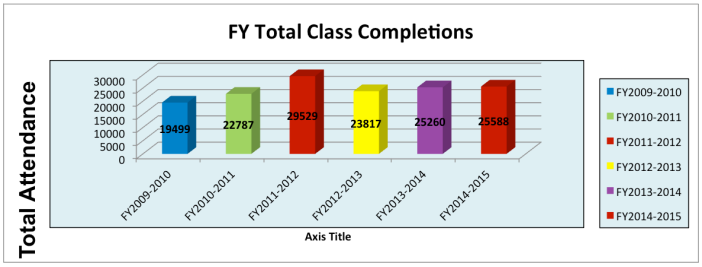
Radiation Safety / Nuclear Regulatory Commission

State and Federal 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)



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.

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 I

Partially satisfies 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 II

Also general in nature but is more informative and is coordinated by and specific to 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 III

By California law, 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 direct

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. EH&S staff provide training approximately six times during the year training on health and safety issues.

EH&S

EH&S training is provided by professional staff within each technical group. A more thorough discussion of each topic and courses offered can be found in the discipline specific sections of this document. EH&S offers nearly 100 different safety related training courses through both online and live in-person delivery. See Appendix B for the full course inventory.

Recordkeeping

Stanford has implemented a central learning management system nicknamed STARS, Stanford Training and Registration System, to centrally manage all compliance related training records. EH&S 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 EH&S Training & Communications group provides direct customer support to any trainees who have difficulty navigating the STARS system or accessing safety related training content.

During 2015, EH&S began the process of updating all EH&S online courses to modern training technology compatible formats, SCORM, to leverage new features and provide a consistent learning experience for EH&S clients. New features include bookmarking capabilities, automatic update of course status upon completion and a consistent look and feel that provides a written script and audio track for all training courses. This effort will continue until all courses are updated. As technology continues to provide new capabilities through new disruptive technologies, EH&S will continue to look for new ways to provide needed training to clients.

Advancements in technology are now making it possible to not just report on who has taken training, but to implement systems to pro-actively identify who requires training and assign that training to the individual and then report on not only who has completed their training but who has not. Working with the Learning Services Group, EH&S has provided

guidance and input on the new STARSTrack tool that will be piloted with select units in late 2015 and 2016. Depending on feedback, the tool should be available to the entire University by the end of 2016. If used comprehensively, this tool should provide greater assurance that those who need training are receiving that training in an appropriate timeline.

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 & Communication responsibilities. The Stanford Safety Manual provides faculty and staff with useful health and safety information and guidelines. Originally, approximately 2500 written copies were originally distributed but now the EH&S website is the primary source of this information. The Safety Manual is no longer printed or maintained.

Distribution of Materials

Target information to specific audiences

The EH&S website is the primary repository of all EH&S resources. A major renovation of the website began in 2014 and should be completed in early 2016. The site takes a renewed approach to user-centered design. All of the site navigation and content strategy was developed using the latest approaches in web design and user-centered approaches. This new design and navigation combined with improved search capabilities will make it much easier for clients to find content they are seeking. Additionally, the design will feature related content so once clients have located content they were originally seeking, they will have an opportunity to explore additional topics or services that may be of interest to them.

The site is built around a few key organizational concepts: Roles, Services, and Topics.

Users can find a Role that matches their role within the University and see a combination of content appropriate for that role, or they can look for a specific service offered by EH&S or simply browse the list of Topics. The new site will be mobile friendly and include a variety of new “features” such as MyEH&S, fillable forms, SOP sharing library, Lessons Learned and Guides, Plans and Manuals. The site will be the foundation for an expandable Stanford Safety Information Service.

Develop new materials

Implementing 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 and mobile devices present new opportunities for delivery of content that is 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 ensuring that all new staff receive 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. It is much more difficult to identify who has *not* taken training than it is to identify who *has* taken

training. The new STARSTrack tool, if implemented comprehensively, should help to narrow the gap and provide greater assurance that those who need training are receiving it.

University Safety Partner Network

The University Safety Partners (USP) 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, Energy and Environmental Sciences, Medicine, Engineering, Independent Labs, Centers, and Institutes, Humanities and Sciences, EH&S, Land, Buildings & Real Estate, Residential & Dining Enterprises, and Athletics. The EH&S Communications and Training specialist provides support to the USP organization. It is critical that there be clear and effective communication between EH&S 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 USPs for effective implementation.

Accident Investigation and Follow-up

The Injury and Illness Prevention Standard requires that there be a system for accident follow-up. The EH&S accident investigation team reviews all accident reports and follows-up, as 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.

Future Needs / Challenges

The Communications Team plays a significant role in the advancement of the Culture of Safety initiative at Stanford. As this is an evolving program, still in its early phases, there is great room for variability in programs to support the effort. At a minimum, the launch and further development of the re-designed EH&S website will be a key component. The initial re-design merely sets the stage for future capabilities and expansion.

The vision for a Stanford Information Service that delivers content when, where and how clients need it is the ultimate goal of the web project. The website should be viewed as only one arm of the information service with other delivery methods being developed to put content in the hands of clients when they need it.

In the training arena, new technologies continue to offer opportunities for improving the delivery and consumption of EH&S training materials. Tools such as the 1-Click initiative designed by the Dean's Office of Research offer new and unique ways of realizing content strategy and delivery.

Throughout the University, greater consistency is needed in the quality and delivery of training programs. The following are some areas where this is needed:

Delivery and Coordination

Training needs to be delivered more consistently. Delivery of both Tier II training programs varies widely throughout the University. Some schools / departments have developed suitable 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. Content needs 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 Learning Management System (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 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. The new STARSTrack system being promoted by the Learning Services Group holds promise to close this gap if implemented fully and comprehensively across the university. As of 2015, the program is in trail mode with several departments and is scheduled for wider release in 2016.

Faculty

New faculty and Principal Investigators (PI) are of particular concern and priority in the training process. 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 a record 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. Again, the STARSTrack tool holds promise for resolving this issue. The success of the program will depend largely on the local implementation of the tool at the department level.

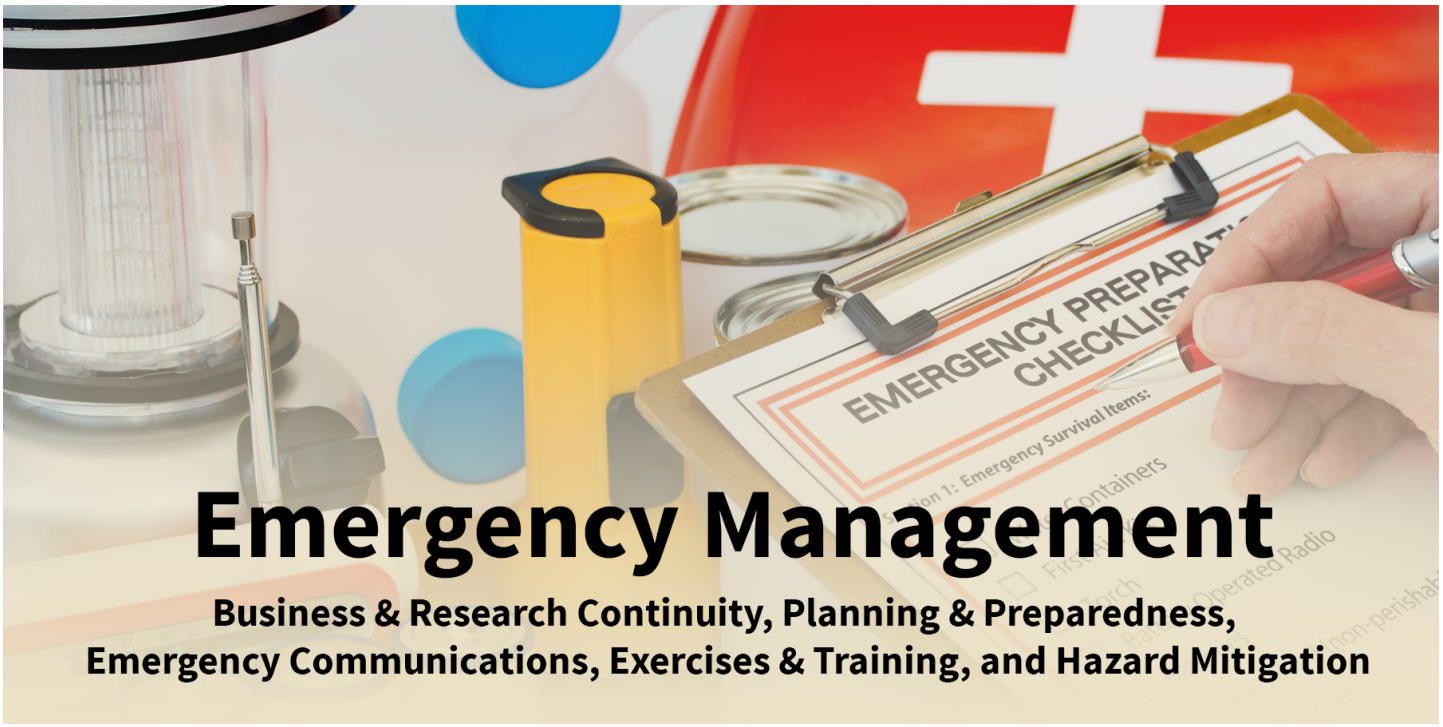
Module Development

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. As technology changes, the training material must be maintained and converted to new technologies to be delivered to new audiences over ever changing delivery mechanisms. EH&S is in the process of updating all EH&S online training to modern SCORM based standards to improve content delivery and end user functionality. All EH&S courses will be updated by 2016. As new courses are requested, EH&S will evaluate the best available technology to develop and delivery EH&S material.

Integration

The more safety training can be integrated with the hiring and HR related processes, fewer people will slip through the cracks and create a regulatory exposure by not taking safety training.

Stanford



Emergency Management

Business & Research Continuity, Planning & Preparedness, Emergency Communications, Exercises & Training, and Hazard Mitigation

This institutional program provides guidance and oversight of the 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. Stanford utilizes a decentralized management approach, and 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.

Supports these University Units:	Technical Services Provided	Business Drivers
• Public Safety • Emergency Management Steering Committee • Departments and Schools • General Workplace Settings • Research Laboratories and Clinics • University Communications	• Planning and Assessment • Emergency Operations Center (EOC) • Response Teams • Emergency Exercises and Preparedness Education • Mass Notification Programs and Emergency Communication • Hazard Mitigation • Business and Research Continuity • Risk Assessments	• Reduction of Impact to Education and Research • Limit Financial Losses due to Disruptive Events • Limit Impact to Institutional Reputation • Disaster Recovery • Business and Research Continuity • Incident Command System

Background

The Stanford University Office of Emergency Management (OEM) in the Department of Environmental Health & Safety (EH&S) serves as the administrative function charged with creating the framework within which the University can reduce vulnerability and sensitivity to hazards and cope with crisis and disasters.

The Stanford University Emergency Management Program's integrated approach to emergency management and business continuity assists the University not only in preparing to respond to emergencies, but also in identifying opportunities to mitigate risk and prevent loss and in establishing business and research continuity and recovery strategies for all types of events – regardless of size and complexity.

The Office of Emergency Management (OEM) coordinates the combined efforts of multiple departments within Stanford into an integrated emergency management program. 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 and integration of these multiple projects into a comprehensive Emergency Management program on behalf of the entire university.

OEM is responsible for developing and coordinating programs that align the disparate elements of the university so they are able to respond in a coordinated fashion during an emergency. These plans also ensure the availability of resources and support necessary to return the university to normal operations as efficiently as possible.

OEM is dedicated to developing programs that are:

- Comprehensive
- Progressive
- Risk-driven
- Integrated
- Collaborative
- Coordinated
- Flexible
- Professional

In any emergency situation, Stanford University's overriding priorities are to:

1. Protect life safety
2. Secure critical infrastructure and facilities
3. Resume the teaching and research missions of the University

The Stanford emergency management program is responsible for identifying and managing programs and projects that minimize or otherwise reduce the impact of disasters to the university. A disaster may cause significant damage to university assets, reputation, or finances and impair the ability of the University to meet its core missions of teaching and research.

History

The existing program was established in 1996, when a management position was developed at EH&S to restructure the University's emergency plans and training programs, previously organized under the University Department of Public Safety. The goals were to:

Prepare comprehensive response plans for emergencies including: earthquakes, fires, major hazardous materials releases, extended power outages, mass casualty events 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 ongoing planning.

Provide a range of training programs for Stanford faculty, staff, and students in order to sustain the University's disaster readiness and response.

Serve as the planning liaison to the local, county and state government emergency planning organizations, as well as to other Universities.

Mandate

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:

- General Industry Safety Orders of Title 8 CCR
- Emergency planning and evacuation orders included in Title 19 CCR
- California State Code (Parts 40 & 59)
- Homeland Security Presidential Directive 5 (02/28/01), Management of Domestic Incidents (HSPD5)
- Code of Federal Regulations (CFR), Title 44. Emergency Management Assistance and the Higher Education Reauthorization Act (2008)
- Public Law 110-315.
- NFPA 1600: Standard on Disaster/Emergency Management and Business Continuity Programs.

Program Elements

Overview

The programs encompassed by OEM can logically be separated into three categories that loosely align with the priorities of the University during an emergency:

- Protect life safety
- Secure the infrastructure
- Resume teaching and research

The three program areas of emphasis are:

- Life Safety & Support
- Operational Response
- Business Continuity & Recovery

Within these areas, there are multiple risks that need to be addressed. Specific programs detailed later in this document are designed to reduce risks in each of the areas.

Life Safety and Support

- Prevent injury or death to students, faculty, staff, or visitors.
- Ability to feed and house residential students.
- Ability to maintain campus safety and security.

Operational Response

- Ability to coordinate response actions.
- Ability to collect situational information needed for strategic decision-making.
- Ability to obtain necessary resources.
- Ability to stabilize and restore building and infrastructure capacity.

Business Continuity and Recovery

- Continuity of critical research processes.
- Retention of faculty and/or students.
- Preservation of critical research data, specimens, and equipment.
- Continuation of educational mission.
- Limit impact to reputation and competitive advantage

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	Area-wide Disaster

A Level 1 event is localized in nature and can be resolved using existing procedures and available resources. Level 1 events do not require the intervention of university management but do require the effective response of a local individual to address the situation. Examples of Level 1 events include: workplace injury, individual law enforcement situation such as a robbery, or a single building alarm or evacuation.

A Level 2 event expands beyond the ability of a single localized individual or area. It usually impacts multiple buildings or a single element of university infrastructure that affects portions or all of campus. A Level 2 event may impact life-safety or mission critical functions. Response and restoration of services can be more effectively accomplished when representatives from the University departments coordinate their response actions. The Campus Emergency Plan is activated and an operational subset of the larger Emergency Management Team, known as the **"Situation Triage & Assessment Team (STAT)"** determines the magnitude of the emergency and coordinates its resolution. Examples of Level 2 events are: large building fire, multiple building or campus wide power outage, chilled water outage, hot water outage, or a major network outage.

A Level 3 event impacts the entire university and the surrounding community. All university response teams are activated in response to the event. Examples of a Level 3 event include: a major area earthquake, serious pandemic, or major active shooter event. The University emergency operations center (EOC) and all local Department Operations Centers (DOCs) are active in response to the event.

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 command and control organization 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 fire training room at Public Safety and the Public Safety Command vehicle.

Stanford University has a long history of focusing on earthquake emergency management, given its location in a seismically active region of the country. While initial programs rightly focused on seismic risks, over time a new approach was required to address a broader range of issues. An "all-hazards" approach establishes response protocols and plans that are flexible enough to address a multitude of scenarios everything from intentional acts of violence, to H1N1, to Ebola.

Organizationally, Stanford is diverse and distributed making planning for the continuity of Stanford University in the aftermath of a major crisis / disaster a very complex task. Preparation for, response to, and recovery from a disaster affecting the University community, dependent populations, and mission critical/time sensitive research and academic functions, requires the leadership, cooperation and participation of, not only senior management, but of all schools and departments, as well.

Emergency Response Priorities for Buildings/Infrastructure

General emergency response priorities derive from the University mission. The contextual characteristics of a particular emergency event (such as the type of emergency, or the time or day when an incident occurs) may cause some adjustments in the following priority categories for building and infrastructure emergency response:

1. Buildings used by dependent populations: on-campus student housing, occupied classrooms and offices, childcare centers, occupied auditoriums, arenas and special event venues.

2. Buildings critical to health and safety: medical facilities, emergency shelters, food supplies, sites containing potential hazards.
3. Facilities that sustain the emergency response: energy systems and utilities, communications services, computer installations, transportation systems, Stanford Sheriff and Public Safety Department, and Environmental Health & Safety.
4. Classroom and research buildings.
5. Administrative and non-academic use buildings.

Planning Assumptions

Stanford's approach to an earthquake is predicated on the assumption that in a regional emergency, immediate outside resources – including emergency response such as fire, medical, police, or external vendors – may not be available to assist. Communication, transportation, health services, and other critical lifelines may be unavailable for up to 72 hours or longer. The Stanford University plan includes guidelines for a long-term response with limited assistance from others at the onset of the emergency.

Emergency Management Team Organization

Stanford employs a tiered incident response, allowing those closest to the event – University staff – to react rapidly to the situation with immediate support and assistance. This approach uses the Standardized Emergency Management System as a model for team organization and communication flow.

A standing Emergency Management Steering Committee (EMCC) provides ongoing oversight and direction for the planning process and programs.

- The Stanford Department of Public Safety Chief of Police chairs the EMCC and is the designated Stanford Incident Commander unless event circumstances dictate that another individual would be more appropriate.
- OEM staffs the EMCC, develops planning and training programs and coordinates special projects such as periodic emergency exercises and resultant after action reports.

The Steering Committee members include:

- Associate Director - Land, Buildings & Real Estate
- Vice Provost - Student Affairs
- Administrative Director – Stanford Health Care / Stanford Healthcare Office of Emergency Management
- Director of Operations - Land, Buildings & Real Estate
- Associate Vice President - Academic Projects & Operations
- Director - Risk Management
- Senior Associate Vice Provost - Residential & Dining Enterprises
- Director of Technology - Land, Buildings & Real Estate
- Director - Vaden Health Services
- Deputy Director - Environmental Health & Safety
- Associate Vice Provost - Environmental Health & Safety
- Assistant Vice President - Business Affairs Finance and Facilities
- Vice Provost Academic Affairs - Provost's Office
- Assistant Vice President for University Communications - University Communications
- Executive Director - Internal Audit
- Manager, Emergency Management - OEM, Environmental Health & Safety
- Director - University Communications/News Service
- Vice President - Land, Buildings & Real Estate
- Executive Director - Computer Services, UIT
- Associate Vice President - Employee & Labor Relations

- Senior Assistant to President - President's Office
- Director - Public Safety

Life safety and support programs

This section outlines the various programs that directly relate to life safety and the immediate support for students, faculty and staff in the aftermath of a major event. Support is focused on ensuring life safety and the availability of shelter and food for the resident population on campus.

Building Structural Safety

Building structural safety will be mentioned more than once in this document. Each time it will be from a different perspective. Building structural safety is included in the life safety and support section to acknowledge that the seismic standards for new facilities combined with the retrofit work that has been done since Loma Prieta has created an environment that is unlikely to incur loss of life due to building structural failure.

Building structural safety will again be addressed in the continuity and recovery section because, although the buildings may fare well from a life safety perspective, depending on the structural stability of the building, it may not support the university goals from the perspective of continuity and recovery of operations. Land Buildings & Real Estate manages the building seismic safety program for Stanford.

Food & Water Reserves

The University has supplies of food and water to support up to 17,000 people for three days. The university will use stored MREs (meals ready to eat) as well and utilizing fresh food stock from the campus dining halls and eateries as well as bottled water reserves. This program is primarily organized and run by Residential and Dining Enterprises. Water reserves are cycled through regular dispensing operations to prevent expiration. Bulk food items are cycled into normal food preparation efforts. MREs are donated prior to expiration and are replenished with new materials on a periodic basis.

Building Assessment and Inspection

The Building Assessment Team (BAT) program is comprised of more than 800 volunteers trained in the ATC-20 Post-earthquake Safety Evaluation of Buildings methodology. BATs assess the exterior of buildings looking for any of eight signs of damage to provide the university with initial assessments of building status after an earthquake. The BATs were created by EH&S in 1998 to support the campus EOC by performing preliminary local damage reconnaissance. Training is offered annually for new BATs and refresher training for existing BATs is offered every other year.

The university also has contracts with twelve structural engineering firms, half in northern California and half in Southern California, contracted to respond to campus to assist with the inspection process. With more than 700 major building on campus, full and complete inspections will take days to weeks, not hours. This program is primarily run out of Land, Buildings & Real Estate, with assistance from the Office of Emergency Management.

Stanford Community Emergency Response Team

During an emergency, it is likely that the City of Palo Alto will not be able to provide the full range of emergency services support to the university 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 campus team following the FEMA Community Emergency Response Team (CERT) model. Members of the team are trained to a higher level of proficiency to assist with medical triage and treatment, light search

and rescue and other post-disaster tasks. They provide additional support in the aftermath of an emergency when professional first responders are unavailable.

Stanford Community Emergency Response Team (SCERT) members are attached to the Department of Public Safety (DPS) 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 2015, the SCERT program 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. The program is run jointly by The Department of Public Safety and the Office of Emergency Management.

Enhanced Fire Sprinkler Program

All Stanford undergraduate residential units have been retrofitted to provide full fire protection with fire sprinklers. Also, over the past two decades, over 95% of research laboratory spaces have had fire sprinklers installed or have been retrofitted with fire sprinklers.

Emergency Assembly Points

All buildings on campus have designated emergency assembly points for evacuation and accountability tasks.

Housing Evacuation Drills

The Stanford Fire Marshal's office conducts emergency evacuation exercises once per year in all undergraduate residential units. Through these drills, students and others identify the locations of the emergency assembly points for their respective buildings and practice emergency evacuation procedures.

Automatic Gas Shutoff for Buildings

All major buildings, including laboratory facilities, are outfitted with seismically activated gas valves that will shut off the flow of natural gas to a building as a result of seismic activity.

Building Response Teams

With the advent of more interdisciplinary buildings, there is a need to better coordinate evacuation and response programs on a facility-by-facility basis. Some schools have developed their own building emergency response teams however, there is currently no single recognized standard for training and equipment for these types of programs or teams. The Office of Emergency Management and The Department of Public Safety are currently evaluating various existing programs to design a model curriculum based on best practices for building response teams.

Student Safety & Support Management

An interdisciplinary team is working to augment emergency response and recovery support provided for students to beyond more than just food and water. The team is looking at better ways to provide students with information, locations to shelter, congregate and receive support, and emergency temporary housing alternatives while buildings are being inspected and approved for re-occupancy after a major earthquake. The team consists of representatives from The Office of Emergency Management, University Information Technology (UIT), Risk Management, Internal Audit and Compliance, The School of Engineering, The School of Medicine, The Graduate School of Medicine, and Land, Buildings & Real Estate.

International Emergency Response

OEM continues to provide technical expertise in support of the Office of International Affairs (OIA) effort on international student response planning and to assist with development of response protocols that mirror the campus response plans and leverage the

AlertSU system for notifying key responders when an incident occurs. In 2014, OEM worked with the OIA team to develop the concept of the iSTAT, the International Situation Triage & Assessment Team. This team parallels the University STAT but contains a carefully selected combination of representatives specifically included because of their knowledge, skills and abilities to handle incidents in international settings.

Campus Risk Assessment

A risk assessment is a process to identify potential hazards and analyze what could happen if a hazard occurs. A component of the Emergency Management for Higher Education grant EH&S received from FEMA in 2009, was the development of a risk assessment model focused on emergency management and incorporating unique characteristics 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 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 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 Risk Assessment tool requires the combined input from multiple campus partners to evaluate each 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 over time.

Preparedness Training

Stanford's emergency response is dependent on the successful implementation of emergency procedures at the local level by individuals and department staff. As departments and individuals better understand their role during an emergency and take responsibility to prepare themselves, all university plans will become more effective. Therefore, OEM continues to provide a proactive emergency preparedness education and training program, which includes training, publications and electronic distribution of preparedness information. Ongoing coordination with the University Safety Partners enhances all of these training and education efforts.

Training

Personal Emergency Preparedness classes are offered on a monthly basis for any interested staff, graduate students, postdocs or faculty. The classes specifically focus on steps that an individual or family can take to be better prepared for a variety of emergency circumstances. A new class was added in 2014 and has enjoyed a significant increase in participation as a result. The original class had 130 attendees during 2013. Since the new course was instituted January 2015, 672 staff, postdocs and faculty have attended through November 2015. The original course has had 1005 attendees through November 2015, since its inception in 2007 and revamp in 2009. In addition, special presentations are scheduled in campus departments throughout the year, upon request. Recent examples include: Residential and Dining Enterprises, Graduate School of Business and SLAC. Both Personal Emergency Preparedness classes 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, Energy and Environmental Sciences. Trainings are also provided for the graduate Community Assistants (CAs) and incoming graduate international students. 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 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 made available for use.

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

All publications were transferred to downloadable formats to encourage local printing by departments and other users.

Operational Response Programs

Many units play a role in the effective response to an incident affecting the University. OEM maintains the overall campus emergency plans which are used as a framework for local departments to develop their own response protocols. Emergency plans should only be activated when existing standard operating procedures are insufficient to handle the situation.

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.

Media Response

The media response program is managed by University Communications. This unit developed plans to manage the anticipated massive influx of media for isolated events such as an active shooter or for regional wide incidents such as an earthquake. Communications programs include contingency plans for an emergency information website on Amazon Cloud services, emergency information hotlines, Facebook, Twitter, and coordination with KZSU radio.

Medical Response

Led by Vaden Health Center, the Campus Medical Response Plan provides immediate triage and

treatment for non-life threatening injuries for faculty, staff, students and campus residential leaseholders after an earthquake or other event where sending individuals to the Hospital is not an option. It is anticipated that during a major earthquake, Stanford Health Care will be faced with an overflow of patients. Vaden will be able to treat patients with lesser injuries who might otherwise be triaged down in the priority treatment list at the hospital. Vaden is also responsible for coordinating mental health support for the campus community post-disaster.

The Campus Medical Response Plan was developed through close collaboration among Vaden Health Center, Environmental Health & Safety, and 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
- Managing patient care, including clinical and support activities.

Infection Control Plans

Also part of the medical response for the campus is the Campus Infection Control Committee. In 2014, the world experienced the largest outbreak of Ebola virus disease (EVD) in history. This outbreak, which started in West Africa, grew to proportions not previously encountered. Recognizing the potential for disruption caused by EVD, the Campus Infection Control Committee convened participants to discuss the potential impacts of EVD and to recommend courses of action to the campus to help keep the campus and its occupants free of EVD or in a worst case scenario, how to handle the situation if one or more EVD cases were present on campus. Response measures included the following:

- The postponement of some academic courses in the West Africa region
- Updates to University travel policy related to travel to West Africa countries
- Contact and tracking of students prior to returning to campus from West African countries for the summer
- Improvements to on campus medical procedures in the event of needing to handle a suspected EVD patient
- Coordination with Stanford Health Care on planning for the possibility of handling EVD patients
- Establishment of a campus Ebola information resource on the web maintained by University Communications to communicate Stanford's policies and approaches to the EVD outbreak

Department Operations Centers

Department Operations Centers (DOCs) are located in or near the administrative headquarters of Deans, Directors, Vice Provosts, and Vice Presidents, and serve as the pivotal communications and information interface between the EOC and the campus community during a major emergency. DOCs can be activated in Level 2 or Level 3 emergencies on campus, as needed.

DOCs 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 six Operational and eight Academic DOCs. Operational DOCs are responsible for providing

specific technical support for the rest of the campus community during an emergency.

Operational DOCs include:

- The Department of Public Safety
- Environmental Health & Safety
- Land, Buildings & Real Estate
- University Information Technology (UIT)
- Residential & Dining Enterprises
- Vaden Health Service

Academic DOCs include:

- Graduate School of Business
- School of Earth, Energy and Environmental Sciences
- Graduate School of Education
- School of Engineering
- School of Humanities and Sciences
- School of Law
- School of Medicine

Partner DOCs include:

- SLAC National Accelerator Laboratory
- The Hoover Institution
- Stanford Campus Residential Leaseholders

The Office of Emergency Management also coordinates response with Stanford Health Care to ensure clear communication and effective response during an emergency.

Formation and Development

The DOCs 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
- 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 to 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 including disaster cost documentation
- Improving the planning process

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.

Situation Triage and Assessment Team

Mainly used for Level 2 events, the Situation Triage and Assessment Team (STAT) provides immediate triage of campus events and coordination of effort and resources to address campus response priorities. 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, President's Office, Provost's Office, Environmental Health & Safety, Land Buildings & Real Estate, Buildings and Grounds Maintenance, University IT, University Communications, Residential and Dining Enterprises and Student Affairs. As necessary and depending upon the type of emergency, other campus specialists such as medical or school based leaders are brought into the STAT response group.

Examples of recent STAT team activation events include:

- GSB Bomb Threat August 14, 2015
- Winter Storm December 11, 2014

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.

Community Partnerships

Stanford works closely with partners in the City of Palo Alto, Stanford Health Care, and the County of Santa Clara as well as with other institutions of higher education to integrate programs and share best practices to ensure a more integrated approach to planning and response.

Stanford also participates in the Palo Alto / Stanford Citizen Corp Council which is based on a federal best practice, designed to integrate government and community resources in partnership for all-hazards preparedness. The Palo Alto / Stanford CCC is the coordinating body for all activity related to emergency planning and homeland security in Palo Alto and Stanford. The CCC is a clearing house for information and best practices, as an advisory body to the City Manager and, therefore, integral to the Emergency Services Council (ESC) of the City.

Stanford has been an active member of the Universities & Colleges Caucus (UCC) within the International Association of Emergency Managers (IAEM). This group was specifically created to help advance the practice of emergency management at institutions of higher education. OEM representatives have served on multiple positions for the organization, including the Chair.

Stanford has also partnered with FEMA to develop exercise scenarios for national tabletop exercises for higher education. Stanford representatives assisted with the development of the National Tabletop for Higher Education held at Northeastern University on October 23, 2014 and at Indiana University on October 26-27, 2015.

Generator Program Efficiency

Stanford has ensured that all primary research facilities are configured with emergency generators to provide limited power to support critical research equipment and processes. All new research facilities are constructed with emergency generators and selected housing and administrative facilities also are capable of sustaining operations due to the availability of emergency power. On-campus fuel storage includes 30,000 gallons of diesel fuel capable of sustaining selected critical operations for up to 72 hours. Operations are selectively deactivated to extend fuel use based on progressive priority. Future improvements to the generator program could involve extension of generator support capacity to IT network systems in certain high priority buildings and improvement in power use within facilities to ensure that high priority equipment is protected. The generator program is coordinated by Land, Buildings & Real Estate.

Emergency Exercise Program

Stanford has conducted numerous exercises over the years to validate and challenge existing emergency plans. Exercises are designed to provide

emergency operation staff experience in managing emergencies in simulated environments and to identify gaps in programs or other areas for improvement. Previous exercise scenarios include multiple different earthquake scenarios, plague and norovirus.

Exercises provide a controlled atmosphere for evaluating emergency response procedures, identifying gaps and implementing corrective actions prior to an actual emergency occurring. Emergency Management in partnership with other campus organizations either organized or participated in the following campus exercises:

- FEMA Virtual Tabletop Exercise January 2015
- SLAC Dark Matter Exercise August 2015
- Campus Notification Virtual Tabletop Exercise April 2014
- Childcare Centers Tabletop February 2014
- Stadium Exercise August 2013
- Executive Team Tabletop Exercise April 2013

In 2016, OEM will implement an initiative to review and update Department Operations Center (DOC) plans and conduct tabletop exercises with Schools, departments and business units. The year-long effort will culminate with a University functional response exercise tentatively scheduled for November 2016.

AlertSU Mass Notification

AlertSU is the University's multimodal emergency notification strategy used to communicate time-sensitive information during events affecting campus. The system is used for both emergency notification and to inform the community of potentially hazardous situations as a result of other on-campus activities, often involving imminent public safety issues. It 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 outdoors 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 any or all of the AlertSU strategy components is appropriate.

Stanford took the unusual approach of automatically "opting in" all Stanford provided email addresses and phone numbers for 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. An "opt-in" approach typically has very low participation rates, which therefore lead to ineffective notification strategies.

The Office of Emergency Management and Department of Public Safety (DPS) continuously monitor technological changes that present new capabilities for mass notification and implements modifications as appropriate. One such improvement was the capability to update the emergency information website and launch the outdoor warning system without personnel having to take the time to log into those other systems to manually update them thereby increasing the speed in which information is available through other modes of the communication strategy.

These improvements where implemented at the end of 2014. Plans are also underway to leverage new VoIP telecommunications capabilities to broadcast messages to indoor phone systems capable of being turned into indoor loudspeakers to reach even further across campus in the case of a dangerous situation. This capability will be available in mid-2016.

The AlertSU mass notification system and sirens are managed by the Department of Public Safety and the emergency website and hotlines are managed by University Communications.

Hazardous Material Response

After an earthquake, many Stanford laboratories are likely to experience chemical spills. The current Stanford hazardous materials spill response team within EH&S has limited resources to address multiple spills simultaneously. The EH&S team is investigating alternatives to augment spill triage and cleanup resources with additional campus staff who can be trained to provide this much needed service. Some external vendors have indicated a capability to perform spill cleanup tasks, however the availability of such resources after an earthquake are likely to be low and not timely. In-house resources hold the most promise for augmenting EH&S responders.

Emergency Operations Center

The Stanford Emergency Operations Center (EOC) uses a modified version of the Incident Command System (ICS) model to organize management during emergencies.

The President and Provost are members of the Command Team for the EOC. 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 the university environment. While the current EOC is located at the Faculty Club, the Office of Emergency Management is actively seeking alternative locations that 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 (disaster) event.

The EOC is only activated for full Level 3 events. When there is a Level 2 event, the 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.

OEM actively manages the storage of critical University information needed to support a full scale response and works with local units to ensure that regular updates are prepared and delivered to the EOC for staging.

Continuity and Recovery Programs

Business Continuity Program

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 either continue the primary missions of teaching and research despite emergency events or to reduce impact and downtime due to such events. Some departments will be expected not only to continue, but also 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:

- ***Critical functions*** performed by the department, and the factors needed for their continuance.
- ***Information and strategies*** that will help during and after the disaster-event.
- ***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 can be used for all types of departments - instructional, research, patient care, as well as administrative and other support units. The tool has limitations in the area of research where the variety of issues is extreme.

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:

- ***Identify an appropriate electronic tool*** to facilitate department plan creation and maintenance (the PrepareSU tool)
- ***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
- ***Monitor planning results for trends*** and gaps that are most effectively addressed on an institutional basis, rather than by multiple individual departments
- ***Research and publish additional resources*** available to assist departments with mitigation strategies.

As of FY 2015, the Graduate School of Business is the single largest organization to engage in continuity planning. Other groups have begun the planning process and are in varying degrees of completion. While the list of departments to begin the planning process has increased, the number of programs actually completing the process is not.

To address this issue, a team composed of members from University IT, Internal Audit and EH&S started convening in 2014 to evaluate the success of the continuity planning process, determine why the process has fallen short of the desired outcomes, and develop a strategy to improve the program.

After completing an initial analysis, members of the team met with executive sponsors to discuss the findings. The results of this has led to a second round of analysis that was to be more heavily data driven and result in a proposal that was to be delivered to sponsors the middle of 2015. Before the report was completed, the team was redirected to work on an Emergency Management and Business Continuity presentation to be delivered to the Cabinet in November 2015 and the Board of Trustees in December 2015. In that last year and a half, the project has generated additional interest from other groups on campus and now includes members from Land Buildings & Real Estate, Residential & Dining Enterprises, Risk Management, The Graduate School of Business, and the School of Engineering.

IT Programs

University IT continues to improve the university communications infrastructure by:

- Having multiple network paths, both on and off campus

- Migrating core enterprise applications to a new Class 1 data center
- Replicating core applications in an auxiliary data center in Livermore
- Performing semi-annual DR exercised to test Livermore applications
- Backing up and encrypting data to three Amazon sites
- Gradually transitioning enterprise applications to the cloud (email & calendar – Microsoft Office 365, collaboration environment – Google, main Stanford website – Amazon, user endpoint backups – CrashPlan, etc.

Seismic Mitigation for High Value Laboratory Equipment

Much of Stanford's research involves the use of valuable scientific instruments. Rough estimates of total equipment value are in the range of $400-500 million. While not all pieces of laboratory equipment require bracing, the exposed risk in this area is significant. In an earthquake, instruments that are unrestrained are likely to be damaged, resulting in a direct financial loss as well as impairing research activity until such instruments are replaced or repaired. The potential wait times for replacement of high value scientific equipment could be extensive thereby further delaying the resumption of research long after facilities are available.

Beginning in 2013, Environmental Health & Safety (EH&S) embarked on a program using matching funds as a financial incentive, to encourage and promote the restraint of high value research equipment. Nearly 2,000 pieces of equipment have been restrained in over 30 research buildings with laboratories in non-formula schools.

The approach used relies on a foundational element referred to as a Universal Restraining Bar (URB) that is affixed to benchtops and provides a base for restraint of equipment as it is placed in the laboratory. Going forward, new laboratory construction and renovations will include installation of the URB on laboratory bench tops where scientific equipment may be at risk. When equipment is moved into the new laboratories, restraint straps are connected from the equipment into the URB.

This convenient and modular approach allows equipment to be moved from benchtop to benchtop with a minimum of effort while maximizing protection. Other equipment in the laboratory may require more elaborate solutions such as floor restraints or even custom solutions for unique or unusually sized or shaped pieces. Some laboratory items were already restrained during installation and will be documented during the next equipment inventory cycle.

By nature of the budget design, the formula schools are not included in the Protect SU program. The School of Medicine has been implementing their own restraint program guidelines and timeline using the guidance and recommendations from the ProtectSU program.

The ProtectSU program is documented on the program website at http://protectsu.stanford.edu. This site provides technical guidance for properly restraining equipment based on equipment characteristics. Characteristics include size, weight, physical location, and specific research functionality, such as being vibration sensitive or needing to maintain equipment mobility.

Principal Program Current & Future Challenges

The near-term goal is to expand preparedness and training programs to address the unique issues of inter-disciplinary 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.

Maintain the ProtectSU seismic non-structural mitigation program

The program will continue to mitigate earthquake losses through maintenance 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, OEM will provide targeted training to specific underdeveloped DOCs, develop strategies to encourage a move toward building-centric life safety plans and department based continuity 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.

Obtain an Operationally Ready EOC

The University establishes an on-site Emergency Operations Center (EOC) following a disaster, to coordinate campus response and strategic decision making. The Faculty Club is the current facility designated as the campus EOC, although it is not certain to be in a usable condition after an earthquake due to its seismic status. Also, it will take several hours to configure for emergency operations. The current Public Safety DOC can serve as a backup EOC if needed.

A Class 1 operationally ready EOC is desirable and was planned as part of a new public safety facility, however this project was suspended following the financial downturn in 2009. Both Public Safety and Environmental Health & Safety are slated to upgrade their facilities in the next few years. This appears to be is an opportune time to consider the outfitting of a modern, robust, and operationally ready EOC that could serve as a primary point of coordination for the university during a time of an emergency, and also to be a valuable part of the campus infrastructure as meeting space or conference facility during normal business operations.

Continue to improve inter-agency coordination

OEM will continue to improve communications regarding emergency response and expectations between Stanford and local jurisdictions 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 a Building Response Team standard

With the advent of more interdisciplinary buildings, there is a need to better coordinate evacuation and response programs on a facility by facility basis. OEM and the Department of Public Safety will continue to evaluate building response team models that exist in the university, Stanford Health Care and other institutes of higher education to design a model curriculum based on best practices for building response teams.

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 cleanups 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 personnel as a model for training additional teams to cover all campus lab areas.

Expand the campus exercise program

In 2016, the Office of Emergency Management (OEM) will implement an initiative to review and update Department Operations Center (DOC) plans and conduct tabletop exercises with Schools, departments and business units. The year-long effort will culminate with a University functional response exercise in November 2016.

The November exercise scenario will begin with a 7.1 magnitude earthquake on the San Andreas Fault. The Emergency Operations Center, Operational DOCs and Academic DOCs will be activated. Exercise play will present both response and recovery challenges as the university team works to restore the Stanford's core missions of teaching and research.

Develop comprehensive mitigation plans

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.

Central Campus Dispatch

Stanford currently has no single point of coordination for information and communications for facilities support. Calls for immediate medical, fire or law enforcement resources are directed to the City of Palo Alto Dispatch via 911 services. Any other request for support related to facilities outages or infrastructure failure may be directed to any number of different points of coordination depending on the building in which the incident occurs. This makes it almost impossible to develop a clear operational picture across the university if multiple events are underway simultaneously such as in an earthquake. In addition, local units are now engaging in contracts with independent security contractors to provide additional local security capabilities without any central coordination of these services. Facilities and UIT monitoring capabilities are in two distinctly separate facilities. This combination of distributed management and coordination makes it extremely difficult to rapidly evaluate the extent of an event and the condition of the university infrastructure for the purposes of making strategic decisions and coordinating operational response.

Combining these multiple monitoring and response capabilities into a single dispatch center would result in increased operational efficiency, reduced confusion for campus occupants and improved response times for response teams while speeding assistance to campus occupants in distress. It also would allow for more rapid ability to affect a lockdown of campus buildings on the Lenel door locking system if needed.

Operationally Ready Buildings

When viewed from a life safety perspective, the Stanford campus facilities achieve a high standard. However, a facility that is constructed to a standard of life safety is still very likely to experience damage during an earthquake and may well require major repairs before being useful again. In order to ensure that more facilities are likely to be useful and operationally ready after moderate to large earthquakes, Stanford should consider the best application of strategically constructed, higher quality buildings that will both support operational response and ensure that high priority functions and research are restored in a reduced amount of time.

Business Continuity Program

From a programming perspective, the business and research continuity programs hold the greatest opportunity for further reducing operational and business risks to the university through the development and implementation of effective continuity programs in academic, administrative and research areas. Combining robust, professional central planning support with an effective and cross functional planning tool and institutional prioritization of continuity planning, the program would make significant progress into the business continuity planning challenge while simultaneously minimizing the administrative burden on individual units involved in the planning process.

Laboratory Research Continuity Program Development

One of the programs most sensitive to disruption by an earthquake is laboratory-based research. There are more than 5,500 externally sponsored projects throughout the university, with the total budget for sponsored projects at $1.22 billion during 2015-16, including the SLAC National Accelerator Laboratory (SLAC).

Research continuity planning seeks to reduce the impact to research by ensuring that laboratories effectively evaluate their research operation to identify potential areas of risk and implement mitigation measures intended to preserve and protect the research process and research products. An effective mitigation program for research would develop strategies and map them to the matching research process and products. Some mitigation strategies such as off-site storage of biological samples incur costs that must be borne by some units. Stanford needs to consider whether it makes sense to establish a centrally managed system rather than leave individual units to create and duplicate efforts to protect research individually.

Strategies available to mitigate research losses include but are not limited to:

- Effective use of emergency power to sustain critical equipment
- Identification of unique samples and employment of duplication strategies
- Implementation of room stable preservation alternatives
- Comprehensive backup strategies for research data
- Implementation of seismic restraint systems for high value equipment

While these benefits are clear, full engagement in business and research continuity planning can be challenging. Facility managers, lab coordinators and researchers across Schools and departments are reluctant to engage in a planning process that takes both time and resources. Business and research continuity planning is a difficult “sell” without a clear priority from the university or a structured program providing consultation and a useful planning tool. It is too often the case that researchers and faculty believe that the university has the capacity to make them “whole” again after an emergency and that this does not require pre-planning on their part.

Stanford

ChemTracker

Chemical Inventory Management, Classified Chemical Database, Chemical Safety Information & Regulatory Reporting

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 as well as advances in web page design and functionality.

Supports these University Units:	Technical Services Provided	Business Drivers
• Research Laboratories and Clinics • General Workplace Settings • Facilities Service Operations • Construction / Renovation	• Reference Database / Data Integrity • Regulatory Reporting • Chemical Safety Information • ChemTracker Consortium	• Laboratory Standard and Hazard Communications Standard (8 CCR) • Regulatory compliance • State/Fed Inventory Reporting

Program Elements

Overview

Reference Database	Regulatory Reporting	Chemical Safety Information	ChemTracker Consortium
• Hazardous materials inventories • Regulatory compliance • Physical / health hazard safety and regulatory information • Regulatory reports • Building / fire code assessments	• Hazardous Materials Business Plan Reporting (HMBP/HMMP) • Spill Prevention Countermeasures Control (SPCC) • Toxic Gas Reporting (TGO) • Bay Area Air Quality Management District (BAAQMD) • IBC and UFC Building and Fire Codes • CFATS Reporting • SARA Reporting	• Safety Data Sheets (SDSs) linkage • ChemInfo Sheets - chemical-specific information • Search- by-hazard function • Safe storage segregation • OSHA / GHS Hazcom • Life Safety Box – emergency response information	• Help desk portal • Inter-member collaboration • Data and technical problem-solving • New member management • Membership meetings • 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 these areas involves:

- Overall program management, plus administrative tasks to support current and new Consortium members as well as inform and recruit prospective members (3.0 FTE)
- IT tasks to establish new member server installation, i.e. 'instance', space
- Data Integrity Group support for new member initial data uploads
- Data Integrity Group maintenance and advancement of the Reference Database, and,
- Customer Support, Data Integrity, and IT troubleshooting and developing improvements to database and user interface.

Major Upgrade

The ChemTracker program, successfully deployed in Fall 2013, represents a major advancement in the software application. The new user interface, CT4, provides a much easier to use interface with greater functionality and allowed for the retirement of the older v3 interface. Further, CT4 incorporates a more stable and sustainable software architecture that provides greater flexibility in troubleshooting program errors, incorporating new functionality, and providing for future application expansion, (e.g., handheld device program interfaces). The improved interface has been a key factor in acquiring new members to the ChemTracker Consortium. Eight new members joined the Consortium in 2013 following the deployment of CT4. The ChemTracker team makes continual improvements to CT4, adding new functionality and enhanced features for more proficient and accurate usage.

The goal of the next series of improvements is to incorporate into CT4 all remaining functionalities of ChemTracker and subsequently retire the original interface, v1. This effort includes migration and improvement of the regulatory reporting functions and expansion of administrative functions, e.g. broad administrative report functions.

Reference Database

Purpose / Goals

Maintain an accurate, extensive database of the physical and health hazards as well as regulatory requirements, storage guidelines, and identifiers associated with specific chemicals and chemical mixtures.

The Reference Database is the core data repository from which other ChemTracker program functions draw. The database contains 36,000 discrete chemicals and chemical mixtures that have been classified based on existing data from reputable sources. (see Chemical Safety Information section below). In addition, the reference database associates synonyms with specific chemical names for a total of 117,000 synonyms. The reference database is continually updated.

The ChemTracker Data Integrity Group (2.5 professional FTE plus 1.0 FTE student assistants) oversees and manages the reference database. Tasks for maintaining the reference database include:

- Classification of chemicals and chemical mixtures for addition to the reference database (20 – 30 minutes per chemical)
- Validation of data with a minimum of three separate reference sources
- Reconciliation and 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 inventory records to be associated or linked with existing reference database chemicals.

The linkage to the reference database taps into the chemical-specific information from which the regulatory reporting functions draw and associates that data with given inventory records to produce regulation-specific and inventory-specific reports. Likewise, linkage to the reference database supports the robust and extensive search capabilities of ChemTracker, allowing users to selectively search their inventories by one or more of a combination of 28 different data fields.

The Data Integrity Group is continually updating the reference database as new information becomes available and meeting additional classification requests from Consortium members. The Data Integrity Group, with support from EH&S IT, also maintains the reporting functionality of ChemTracker (see Regulatory Reporting section below).

Regulatory Reporting

Purpose / Goals

Produce regulatory reports that meet regulatory reporting requirements by maintaining an accurate, extensive reference database that allows for effective linkage of specific chemical inventory records to applicable regulations.

(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, SARA Title III, California Public Resources Code Sections 21000-2117688 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, and the Department of Homeland Security, 6 CFR Part 27 Appendix A: Final Rule, Chemical Facility Anti-terrorism Standards)

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 chemicals, distributed across many buildings and thousands of rooms. Stanford's EH&S Hazardous Materials Management program uses ChemTracker to document and report on the campus's

chemical inventory that consists of 17,115 different chemicals in 280,398 separate containers distributed across 2,218 rooms in 222 buildings. These figures represent a 14% increase in the number of different chemicals and a 12% increase in the number of individual containers since 2012. There are currently 2,130 active Stanford ChemTracker users operating under 800 distinct inventory owners.

The ChemTracker reference database and report generation functions are the key to Stanford and the Consortium member institutions complying with the numerous and complex regulatory reporting requirements. The hazardous materials inventory reporting requirements vary widely between jurisdictions. For example, New York City and the State of Nevada requirement are very specific to those locales. Consequently, ChemTracker Consortium members heavily depend upon the ChemTracker reporting functions to meet their jurisdictional-specific regulatory reporting obligations.

The Data Integrity Group stays abreast of applicable regulatory changes. The group also maintains the ChemTracker reporting functions by comparing available chemical, health and safety information with the applicable environmental, health and safety regulations. The report functions then compile all the associated inventory entries and place 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.

Programs with inventory reporting requirements include:

- California Environmental Reporting program (new state level online reporting of HMIS … available to Santa Clara County);
- 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)plus,
- U.S. Department of Homeland Security's CFATS screening requirement related to potential terrorist threats against facilities with certain hazardous materials exceeding specific quantity thresholds.

Project Planning

Purpose / Goals

Provide a means by which Stanford University Fire Marshal Office (SUFMO) can assess the building and fire code impacts of specific chemical inventories related to laboratory remodel or new construction projects. The goal is to proactively identify the correct code occupancy requirements and research group placement as driven by the respective chemical inventories.

(Regulatory Drivers: California Building Standards Code (CBC), CCR Title 24, Parts 2, 9)

SUFMO utilizes two key functions in ChemTracker to support project managers in assessing the building and code implications of specific chemical inventories. These key functions are:

- Cloning: Ability to copy an existing building and room(s) and the commensurate chemical inventory into a separate planning instance
- Project Planning Instance: A separate chemical inventory data instance, distinct from Stanford University's production ChemTracker inventory instance.

SUFMO uses the cloned building/room(s) chemical inventory in the planning instance to project/model how the inventories affect construction design requirements.

The value of this is to ensure compliant construction design and effective space assignments ahead of time, thus avoiding costly post-project changes.

Chemical Safety Information

Purpose / Goals

Provide access to chemical safety information and Safety Data Sheets (SDSs) independent of a user's specific inventory.

(Regulatory Drivers: 8 CCR 5194(e)(A), (g)(1)(10), (h)(1), SARA Title III, Section 311-3128 CCR 5191(f)(3)(E))

Information resources provide chemical-specific health and safety information critical in ensuring safe chemical handling, development of SOPs for laboratory procedures, and safe segregation in storage. It is a core requirement of OSHA's Lab Standard and Hazard Communication Standard for employees to have easy direct access to health and safety information in their work area regarding the hazards to which they may be exposed. The ChemTracker program's Chem Info sheets (derived from the reference database), coupled with a quick link to access Google search-based Safety Data Sheets (SDSs), helps ensure readily accessible access to chemical-specific information. In addition, Stanford has augmented its ChemTracker program with an online SDS service that is available to all Stanford students, employees and faculty even if they are not registered ChemTracker users.

The ChemTracker program is also a source of chemical safety information that is used by EH&S safety professionals and emergency response personnel. ChemTracker provides very specific information on the physical and health hazards presented by a given chemical or chemical mixture along with safe storage guidelines. EH&S professionals utilize this information to provide consultative assistance to research groups as well as to provide compliance oversight. In addition, EH&S personnel, in conjunction with emergency response personnel, utilize the information to be able to respond in a safer, more prompt and accurate way, thus contributing to a more effective resolution to an incident. ChemTracker 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 includes a cover page that presents a quick reference (with DOT icons) to the major hazards. This gives first responders a quick snap-shot of the chemical hazards in a particular room without having to enter the room to gather the same information. Working with the campus EH&S professionals, first responders can access Life Safety Box reports remotely without entering the building in which the incident is reported, providing a wider margin of safety for the responders. While the Life Safety Box report is not mandated by any regulation, it provides significant additional value to the emergency first responders.

The Data Integrity Group continues to provide the critical operational support to ensure that the Reference Database is up to date and operational to supply the chemical safety information.

ChemTracker Consortium

Purpose / Goals

Facilitate a membership-based consortium of more than 54 colleges and universities (the Consortium) 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 35 members including Stanford, CUNY (with 19 discrete campuses), The Scripps Research Institute plus the University of Florida, for a total of 54 discrete data instances. Thus far, we have added four new members in 2015: University of Texas, Dallas, Bowling Green State, University of Florida A&M University and California Lutheran University. The continual growth in the membership has been achieved by ensuring timely direct telephone contact with prospective new

members, presenting frequent webinar-based demonstrations of the application, increasing the outreach communication to existing members and creating a more visible presence at professional conferences (e.g. CSHEMA).

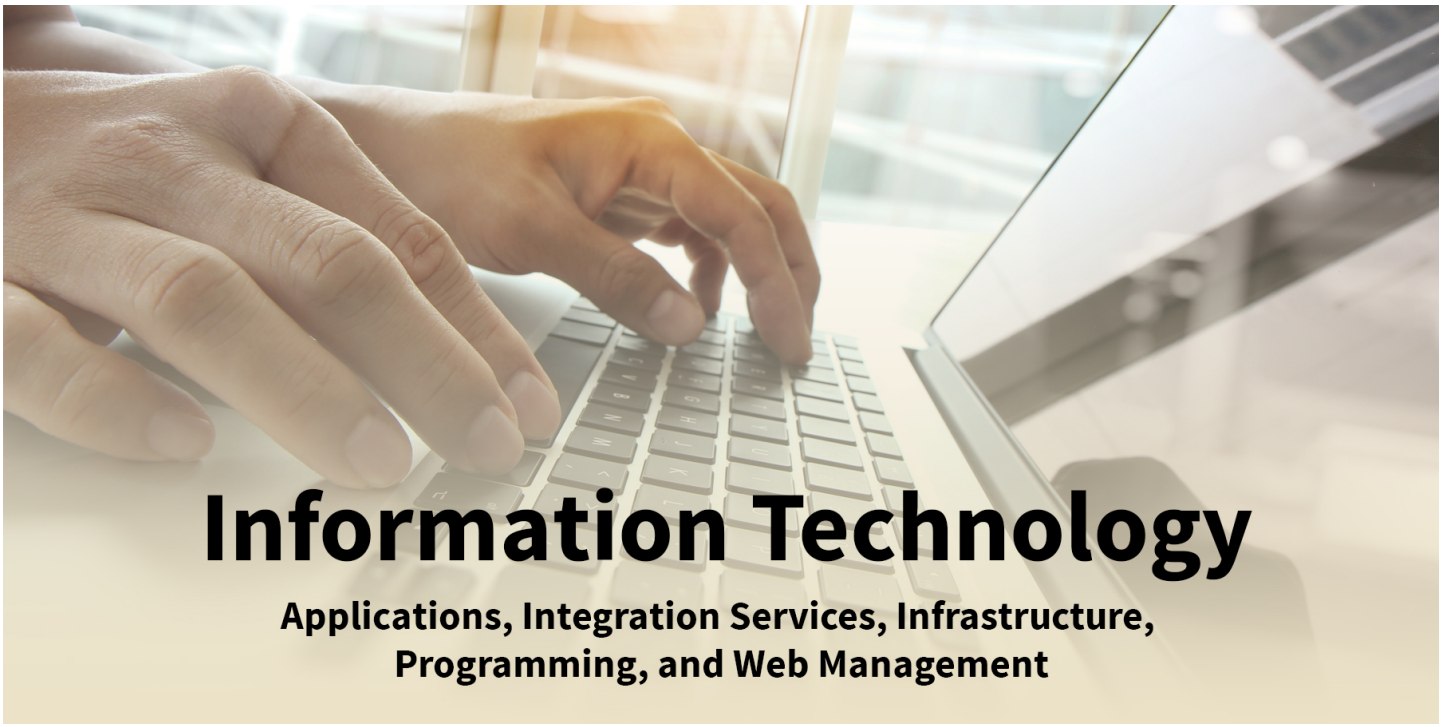
The ChemTracker Customer Support Group assists Consortium members by the following means:

- Maintaining a help request portal (ChemTracker_support@lists.stanford.edu)
- Responding to and facilitating the correction of data and technical problems
- Assisting new members in implementing ChemTracker at their institution
- Maintaining the ChemTracker website (https://ChemTracker.org)
- Producing and maintaining user training guides and tools on the ChemTracker website
- Facilitating intra-consortium networking by hosting webinar Consortium meetings to provide information and assistance to the local ChemTracker administrators and executive contacts at each institution.
- Composing and disseminating a quarterly ChemTracker e-mail newsletter, highlighting new developments and tips for more proficient usage of ChemTracker;
- Performing QA testing of newly developed functionalities and/or corrections to the application prior to promotion to members' application instances.

The Stanford ChemTracker program promotes collaboration within the Consortium and higher education community with extensive outreach efforts. This outreach includes increasing program visibility at the annual CSHEMA conference as well as CSHEMA regional conferences. At the 2014 CSHEMA conference, ChemTracker Program Manager, Kevin Creed, gave a technical presentation, "Extracting Optimum Usage of Chemical Inventory Data".

For the 2015 annual CSHEMA conference, the ChemTracker program had an exhibitor booth to increase face-to-face contacts with CSHEMA conference attendees, build an expanded contact list, and implement a proactive approach to recruiting new consortium members. Also in 2015, Kevin Creed attended the Pacific Northwest regional CSHEMA conference, likewise staffing a vendor table and attending technical sessions. In early 2016, CSHEMA is hosting a California regional conference to be held at Google headquarters in Sunnyvale, CA. The ChemTracker program plans on being active participants in this regional conference.

Stanford



Information Technology

Applications, Integration Services, Infrastructure, Programming, and Web Management

Information Technology

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, business analysis, 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
• Administration • Asbestos • Biosafety • Hazardous Materials • Health Physics • Industrial Health • Occupational Health Center • SUFMO • Training & Communication	• Applications (Development) • Business Analysis • Project Management • Integration Services • Infrastructure • Programming • Web Management	• ChemTracker • Hazardous Waste • STARS

Program Elements

Overview

Project Services	Operational Services
• EH&S Administrative Systems (application development and business analysis) • ChemTracker Systems (application development and project management) • Integration Services • Infrastructure • Project and Program Support	• Application Monitoring and Support • Website Management • Desktop Support • Infrastructure Support • ChemTracker Instance and Programming Support

Background

Currently, the IT groups counts nine full-time professionals where 75% of the resources are used for projects and the remaining 25% is utilized for operational services. Over the past year, about 80% of IT-managed resources have been allocated to the ChemTracker program.

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 and to cloud-based servicesAdded business analyst and project management capabilitiesIncreased technical support for ChemTrackerand Increased outreach to other University organization such as Administrative Systems (AS), Lands, Buildings & Real Estate (LBRE), University Information Technology (UIT) and Information Security Office (ISO).

1. Implementation of MIE occupational health system
2. Implementation of BioRAFT inspection platform
    a. Electronic Process, Document and Collaboration Improvements (including Departmental Document and Records Management, new file storage
    b. Health Physics System Replacement with the possibility of implementing the BioRAFT Health Physics module
3. Application and Data Security and Robustness (including Application-Data-User Mapping, Data Classification, IT Continuity Plan, Server Redundancy at Livermore Server Facility
4. ChemTracker Projects
5. Migration of EH&S online classes to STARS
6. Build competency and experience in API development and integration
7. Software Development Process Improvements (including Source Control, Bug Tracking, Configuration Management, and Project Site).

The IT group is evaluating advances in cloud computing and storage with the purpose of utilizing such solutions when it will improve the quality of service as well as being financially sound.

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 small 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, 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 postponedand
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 Git 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 JIRA, Blossom and Slack. *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).

ChemTracker Systems (application development)

and goals of the previous section describing the application development of EH&S administrative systems.

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, STARS EH&S training completion records 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).

Infrastructure

EH&S rents three racks containing 15 servers and KVM switches. Most workstations and laptops at EH&S contains Microsoft Windows 8 or 10 with a varied degree of Microsoft Office 2010 and 2013.

Project and Program Support

In past years, the IT group has been increasingly involved in non-technical support to EH&S programs and initiatives. TWe 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 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

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: NtiretyPhysical hosting of most EH&S servers: Stanford Information Technology Services (ITS), Linux administration of a four Linux-based EH&S servers: ITSServer backup of a four Linux-based EH&S servers: ITSEmail and calendaring: The first-level user support is with EH&S IT, and the operations and second-level user support is with ITSand 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 groupSetting up database accounts, database structures, and applications for new ChemTracker membersTechnical bug fixingand Implementing new functionality or changes to existing functionality. One FTE is allocated.

Appendix A
Summary of Programs

	Supports these University Units	Technical Services Provided	Business Drivers
Occupational Health & Safety	• Research Laboratories and Clinics • General Workplace Settings • Facilities Service Operations • Construction / Renovation	• Biosafety • Ergonomics • Industrial Hygiene • Laboratory Safety and Chemical Hygiene • Facility Construction, Renovation, Maintenance, and Decommissioning • Hazardous Materials Management • Safety and Compliance • Workplace Safety	• Assurance of a safe and healthful work environment • Institutional regulatory compliance
Health Physics	• Research Laboratories • Stanford Hospital and Lucille Packard Children's Hospital • Veterans Affairs Palo Alto Health Care System • Radiochemistry facilities • Research Committees • Construction / Renovation	• 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	• 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	• Stanford Main Campus • School of Medicine • Hopkins Marine Station • SLAC National Accelerator Laboratory • New construction and remodeling	• 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	• 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	• Research Laboratories and Clinics • Facilities Service Operations • Construction / Renovation	• Hazardous Waste Programs • Air emissions • Wastewater discharge • Hazardous Material Spill Prevention and Response • Historical Releases • Plan Reviews • Sustainability • Toxic Substances Control Act	• Environmental Protection Agency (EPA) • Bay Area Quality Management District • County of Santa Clara Department of Public Health • Regional Water Quality Control Board

Training & Communications	• General Workplace Settings • Research Laboratories and Clinics • Facilities Service Operations • Construction / Renovation	• Compliance Training • Three Tiers of Training • Course Delivery • Recordkeeping • Communications / Publications / Delivery of Materials	• University employees • Research involving hazardous materials (bio / chem / rad) • Risk Management • Accident Investigations
Emergency Management	• Public Safety • Emergency Management Steering Committee • Departments and Schools • General Workplace Settings • Research Laboratories and Clinics	• Planning and Assessment • Emergency Operations Center (EOC) • Response Teams • Emergency Exercises and Preparedness Education • Mass Notification Programs • Hazard Mitigation • Business Continuity • Risk Assessments	• Disaster recovery and Business Continuity • Incident Command System
ChemTracker	• Research Laboratories • and Clinics • General Workplace Settings • Facilities Service Operations • Construction / Renovation	• Reference Database / Data Integrity • Regulatory Reporting • Chemical Safety Information • ChemTracker Consortium	• Laboratory Standard and Hazard Communications Standard (8 CCR) • Regulatory compliance
Information Technology (EH&S IT)	• Administration • Biosafety • Hazardous Materials • Health Physics • Training	• Applications (Development) • Integration Services • Infrastructure • Programming • Web Management	• ChemTracker • Hazardous Waste • STARS

Appendix B

Inventory Of Environmental Health & Safety Training Courses

General Safety-EHS-4200	
Course Description:	General Safety, IIPP, and Emergency Preparedness covers practices and procedures for preventing employee injury or illness from potential workplace hazards. Appropriate for all employees and students in administrative and other work environments.
Regulatory Reference:	8 CCR 3203(a)(7): https://www.dir.ca.gov/title8/3203.html

General Safety Processes and Prevention: Incident Reporting and Causal Analysis-EHS-4201	
Course Description:	An ancillary to General Safety, EHS-4200. Review of workplace injuries and illness prevention processes. Focuses on incident reporting and analysis. Working group format to review injuries, factors and preventive solutions.
Regulatory Reference:	N/A

Life Science-EHS-4875	
Course Description:	This course covers the proper use, storage, handling and emergency procedures for biohazardous agents, compressed gas, hazardous chemicals, and hazardous waste in laboratories.
Regulatory Reference:	Cal/OSHA 8 CCR 5191(f): https://www.dir.ca.gov/title8/5191.html 5193(g): https://www.dir.ca.gov/title8/5193.html

Chemical Safety-EHS-1900	
Course Description:	Chemical Safety for Laboratories covers the Stanford's Chemical Hygiene Program for safe handling of chemicals and chemical waste in the lab. It provides resources for assessing and controlling hazards and complying with applicable laws and regulations.
Regulatory Reference:	Cal/OSHA 8 CCR 5191(f): https://www.dir.ca.gov/title8/5191.html

Compressed Gas-EHS-2200	
Course Description:	Compressed Gas Safety covers the general safety procedures for the proper use, storage, and handling of compressed gases.
Regulatory Reference:	8 CCR 3203(a)(7): https://www.dir.ca.gov/title8/3203.html IIPP regs 461, 3301, 4649-4650

Cryogenic Liquids and Dry Ice Safety-EHS-2480	
Course Description:	Cryogenic Liquids and Dry Ice Safety covers the hazards and general safety procedures for the use, storage, and handling of cryogenic liquids and dry ice.
Regulatory Reference:	Cal/OSHA 8 CCR 3203(a)(7): https://www.dir.ca.gov/title8/3203.html

Biosafety-EHS-1500	
Course Description:	Biosafety covers the safe use, handling, and disposal of biohazardous agents, and reviews emergency procedures for occupational injuries or biological material spills.
Regulatory Reference:	8CCR 5193: https://www.dir.ca.gov/title8/5193.html

Bloodborne Pathogens-EHS-1600	
Course Description:	In the Stanford Health & Safety Bloodborne Pathogen Training Program, you will learn methods of protecting yourself from potential exposure to bloodborne pathogens in your workplace. It also covers the very important procedures that must be carried out should accidental exposure occur. The program is organized into sections, beginning with a description of the bloodborne pathogens regulations and a description of the terminology used. At the end of the program is a brief quiz designed to test your knowledge of bloodborne pathogens. Once you have successfully answered the questions you will be registered with the Health & Safety Department and your department supervisor as having completed the Bloodborne Pathogens Training Course. The entire program and quiz should take less than an hour. Recertification is required annually.
Regulatory Reference:	8 CCR 5193(g)(2): https://www.dir.ca.gov/title8/5193.html

Laser Safety-EHS-4820	
Course Description:	Laser Safety provides tips on using engineering and administrative controls to prevent laser hazards and accidents. Renewal is due every 3 years Topics Include: Fundamentals and classifications of lasers; laser beam and none-beam hazards; controlling laser hazards through engineering.
Regulatory Reference:	8 CCR 8416: https://www.dir.ca.gov/title8/sub20.html OSHA Instruction PUB 8-1.7: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=1705&p_table=DIRECTIVES

Hazard Communications-EHS-4300	
Course Description:	Hazard Communication covers basic chemical safety information, personal protection equipment (PPE), and the rights & duties of employees working with or around hazardous chemicals in non-laboratory settings.
Regulatory Reference:	Cal/OSHA 8 CCR 5194(h): https://www.dir.ca.gov/title8/5194.html

Hazard Communication for Supervisors-EHS-4301	
Course Description:	Hazard Communication (HazCom) covers chemical safety information and the rights/duties of employees working with hazardous chemicals in non-laboratory settings. This training also covers supervisor instructions for HazCom Standard revisions training.
Regulatory Reference:	Cal/OSHA 8 CCR 5194(h): https://www.dir.ca.gov/title8/5194.html

Shipping Biological Goods-EHS-2700	
Course Description:	Shipping Dangerous Biological Goods/ Dry Ice trains employees to properly package, label, and document shipments of hazardous biological materials or dry ice for transportation by common carriers. Course provides initial certification. DOT: Shipping Dangerous Biological Goods or Dry Ice provides certification for those who pack or ship hazardous biological materials and/or dry ice for transportation.
Regulatory Reference:	49 CFR 172.7, IATA, PHS

Radiation Safety-EHS-5250	
Course Description:	This 8 hour radiation safety training consists of 2 hours of radiation physics, 1 hour of radiation biology, 2 hours of hazards and protection, 1 hour of administrative procedures, 1 hour of regulations, and 1 hour of monitoring.
Regulatory Reference:	Title 10, Code of Federal Regulations Part 835, Occupational Radiation Protection: http://www.ecfr.gov/cgi-bin/text-idx?SID=01f5e202b860e74980aa767d903f0128&node=pt10.4.835&rgn=div5

Radiation Safety Questionnaire for Users of Cabinet X-ray or Irradiators-EHS-1755	
Course Description:	This test should be a learning experience to help those using Cabinet X-ray Machines or Irradiators work with these devices safely.
Regulatory Reference:	N/A

Handling Controlled Substances-EHS-2125	
Course Description:	Required for all PIs and Authorized Researchers who are enrolled under Stanford University's Controlled Substances Program. This training describes the required enrollment process, procedures, inspections, inventories, waste management, loss, suspect diversion, lab moves, and personnel changes.
Regulatory Reference:	Code of Federal Regulations: Title 21, Chapter II (Parts 1300 to end): http://www.deadiversion.usdoj.gov/21cfr/cfr/ Health and Safety Code Division 10: California Uniform Controlled Substances Act: http://law.justia.com/codes/california/2011/hsc/division-10

Intro to Compliance Assistance Safety–EHS-4775	
Course Description:	An introduction for Biology students to the EH&S department, Safety and Compliance Program, and the services they offer highlighting the on-line Hazardous Waste management application.
Regulatory Reference:	N/A

Lab Wastewater-EHS-4805	
Course Description:	Researchers, lab users and students will receive information regarding Stanford's Wastewater Permit: overview of wastewater compliance program, acceptable discharges to the sanitary sewer, sewer discharge limits and wastewater inspection recommendations.
Regulatory Reference:	Palo Alto Sewer Use Ordinance

Lab Ergonomics-EHS-4800	
Course Description:	This course trains researchers on proper workstation setup and ergonomic work practices in a laboratory work environment, with a focus on repetitive/continuous tasks such as microscope use, pipetting, and miscellaneous hand tool use.
Regulatory Reference:	Cal/OSHA 8 CCR 5110(b)(3): https://www.dir.ca.gov/title8/5110.html

Computer Ergonomics-EHS-3400	
Course Description:	Prevent ergo problems that arise from daily computer use. Course focuses on proper workstation setup and ergonomic work practices.
Regulatory Reference:	Cal/OSHA 8 CCR 5110(b)(3): https://www.dir.ca.gov/title8/5110.html

Asbestos Awareness-EHS-1100	
Course Description:	Required for employees whose jobs include facilities maintenance or renovations tasks; anyone who supervises or manages such tasks.
Regulatory Reference:	Cal/OSHA 8 CCR Section 1529 (Asbestos): https://www.dir.ca.gov/title8/1529.html Cal/OSHA 8 CCR Section 5194 (Hazard Communication): https://www.dir.ca.gov/title8/5194.html

Asbestos Abatement Skills-EHS-1150	
Course Description:	Asbestos Abatement Skills consists of field exercises to teach the "hands-on" skills needed to safely abate small amounts of asbestos- containing materials. W/ Asbestos Awareness (EHS-1100) Cal/OSHA Class III training requirements are met.
Regulatory Reference:	Cal/OSHA 8 CCR Section 1529: https://www.dir.ca.gov/title8/1529.html

Asbestos Awareness for Custodians –EHS-1200	
Course Description:	This course is restricted to Stanford's Residential & Dining Enterprises Department custodial staff only. It fulfills the Class IV training requirements for Cal/OSHA.
Regulatory Reference:	Cal/OSHA 8 CCR 5208: https://www.dir.ca.gov/title8/5208.html

Asbestos Awareness for Supervisors-EHS-1250	
Course Description:	Recommended for construction and facilities supervisors. Identifies types and location of asbestos-containing materials found on campus, health effects, laws and regulations, regulatory and civil liabilities.
Regulatory Reference:	N/A

Automatic External Defibrillator (AED)-EHS-1300	
Course Description:	The class trains employees in the use of AED, CPR and First Aid, and meets the standards required by California for AED use.
Regulatory Reference:	CCR Title 22. Division 9. Chapter 1.8 Article 3. Section 100038

AED and CPR – EHS-1305	
Course Description:	Class trains employees in the use of AED and CPR to help a victim of sudden cardiac arrest. Certification to be renewed every 2 years
Regulatory Reference:	N/A

First Aid and CPR-EHS-4050	
Course Description:	Course includes instruction on the proper first aid for burns, bleeding, shock, heart attacks and strokes, seizures, clearing airways, ventilations, chest compressions and more.
Regulatory Reference:	N/A

Back Safety/Safe Lifting-EHS-1400	
Course Description:	The class trains employees in the use of AED, CPR and First Aid, and meets the standards required by California for AED use.
Regulatory Reference:	8 CCR 3203(a)(7): https://www.dir.ca.gov/title8/3203.html IIPP regs & Ergo regs 5110(b)(3): https://www.dir.ca.gov/title8/5110.html

Benchtop Treatment of Hazardous Waste EHS-EHS-1450	
Course Description:	Bench Top Treatment covers time limits, volume limits, emergency response and record-keeping.
Regulatory Reference:	CAC- 25200.3.1

Building Assessment Team (BAT) Training-EHS-1650	
Course Description:	Voluntary Program: BAT training certifies you to be a part of the volunteer post earthquake assessment team. You will learn to conduct an external assessment of a building looking for any of 8 specific signs of damage.
Regulatory Reference:	Voluntary program.

Building Assessment Team (BAT) Training - Refresher-EHS-1651	
Course Description:	Voluntary Program: BAT Refresher training reinforces concepts taught in the original BAT class and provides practical experience using images of real campus buildings.
Regulatory Reference:	Voluntary program.

Confined Space Entry-EHS-2300	
Course Description:	Confined Space Entry teaches participants to recognize, evaluate, and safely conduct permit-required confined space entry operations.
Regulatory Reference:	Cal/OSHA 8 CCR 5157(g), 5158(c)

DOT: Shipping Hazardous Materials, Excepted Quantities-EHS-2650	
Course Description:	This course provides instruction in identification, packaging and air shipment of small quantities of hazardous chemical materials.
Regulatory Reference:	49CFR Part 172, Subpart H: http://www.gpo.gov/fdsys/pkg/CFR-2011-title49-vol2/pdf/CFR-2011-title49-vol2-sec172-704.pdf

Electrical Safety-EHS-2800	
Course Description:	Introductory course covering general precautions on the use and care of electrical equipment.
Regulatory Reference:	Cal/OSHA 8 CCR 3203(a)(7): https://www.dir.ca.gov/title8/3203.html 2320.1

Ergonomics Computer Workstation-EHS-3400	
Course Description:	Prevent ergo problems that arise from daily computer use
Regulatory Reference:	8 CCR 5110(b)(3): https://www.dir.ca.gov/title8/5110.html

Ergonomics Awareness-EHS-3600	
Course Description:	Ergonomics Awareness provides field ergonomics training specific to a department or unit. Job tasks are reviewed with staff, discussing ergonomic risk factors and best practices to support local efforts toward prevention of workplace musculoskeletal stressors.
Regulatory Reference:	8 CCR 5110(b)(3): https://www.dir.ca.gov/title8/5110.html

Fire Extinguisher Training-EHS-3700	
Course Description:	Fire Extinguisher Use gives hands-on experience using a portable fire extinguisher. Learn about the types of fire extinguishers and how to use them. General fire safety topics will also be covered.
Regulatory Reference:	8 CCR 6175: https://www.dir.ca.gov/title8/6175.html

Fire Extinguisher Use in Labs-EHS-3825	
Course Description:	This class covers the hazards associated with fires in laboratory environments with emphasis on extinguishment of flammable liquid and flammable metal fire.
Regulatory Reference:	8 CCR 6175: https://www.dir.ca.gov/title8/6175.html

Fire Extinguisher Use and Inspection-EHS-3850	
Course Description:	An online video covering fire extinguisher use, classification according to fire type, and inspection to ensure readiness.
Regulatory Reference:	8 CCR 6175: https://www.dir.ca.gov/title8/6175.html

Fire Safety for Kitchens-EHS-3900	
Course Description:	This course is for employees who work in one of the various kitchens on campus. The class has two parts; a lecture presented in the kitchen and then a hands-on experience using a portable fire extinguisher. First Aid for burns is covered.
Regulatory Reference:	N/A, A University program

Forklift Safety –EHS-4100	
Course Description:	Forklift Safety covers operating rules and pre-operational safety/maintenance inspection of forklift equipment. Required for all employees whose job it is to operate forklifts.
Regulatory Reference:	8 CCR 3668: https://www.dir.ca.gov/title8/3668.html

Hazardous Materials Response Training for Labs & Shops-EHS-4400	
Course Description:	Hazardous Materials Response Cleanup for Labs/Shops provides methods and personal protection needs for cleaning up small spills.
Regulatory Reference:	University Policy

Hazardous Materials Waste Accumulation Areas (WAA)-EHS-4600	
Course Description:	Training for managing hazardous wastes. Annual refresher training is required.
Regulatory Reference:	22 CCR 66264.16: https://www.dtsc.ca.gov/LawsRegsPolicies/Title22/

Hazardous Waste Management for Shops-EHS-4650	
Course Description:	Regulatory requirements and compliance strategies for hazardous wastes generated in Stanford shops such as: paints, oils, cleaners, thinners, treated wood, and herbicides/pesticides.
Regulatory Reference:	40 CFR Part 110 Section 112.7: http://www.epa.gov/OEM/docs/oil/spcc/guidance/B_40CFR110.pdf

Hearing Conservation-EHS-4700	
Course Description:	Hearing Conservation covers the procedures to prevent hearing loss due to hazardous levels of sound/noise in an employee's work area.
Regulatory Reference:	8 CCR 5099: https://www.dir.ca.gov/title8/5099.html

Heat Illness Prevention – EHS-4710	
Course Description:	Heat Illness Prevention addresses how to prevent heat illness in the workplace in particular for employees who work outdoors.
Regulatory Reference:	Cal/OSHA 8 CCR 3395(f): https://www.dir.ca.gov/title8/3395.html

Hot Work Permit-EHS-4725	
Course Description:	Hot Work training for construction project supervisors and tradesmen/women. Will cover associated hazards, applicable requirements and safety procedures. Supervisors completing training will be authorized to issue hot work permits at Stanford.
Regulatory Reference:	TITLE 8 CCR Sections 4794 - 4799 and articles 82,83,87,88, & 90 (29 CFR 1910. 251 - 255) (29 CFR 1926. 350 – 354) https://www.dir.ca.gov/title8/4799.html

Incident Command System Training for Department Operation Centers-EHS-4750	
Course Description:	An introduction to the Incident Command System for members of University Department Operations Centers. Explains the basic principles employed in Emergency Management and how Stanford organizes its emergency management functions.
Regulatory Reference:	N/A

Ladder Safety-EHS-4810	
Course Description:	Ladder Safety and Roof Safety guidelines for maintenance staff.
Regulatory Reference:	8 CCR 3203(a)(7) 3209-3214, 3276-3280: https://www.dir.ca.gov/title8/3203.html

Lockout Tagout-EHS-4900	
Course Description:	Lockout/Tagout provides procedures to safeguard employees who maintain, service, or operate equipment that could cause injury from unexpected energization/start-up or unexpected energy release (electric current, steam, hydraulic, compressed springs).
Regulatory Reference:	Cal/OSHA 8 CCR 3314: https://www.dir.ca.gov/title8/3314.html

Machine Shop Safety-EHS-5000	
Course Description:	To train staff on the potential hazards associated with shop machinery and ways to minimize hazards. Topics covered are proper attire, protective equipment, safe practices, injury reporting, and required training to work safely in a shop environment.
Regulatory Reference:	8 CCR 3203(a)(7) : https://www.dir.ca.gov/title8/3203.html General IIPP regs

Emergency Preparedness in your Home-EHS-3201	
Course Description:	Learn how to prepare yourself, your family and your home to survive the next disaster. You will receive information on earthquakes, family preparedness plans, and building your own disaster kit. The class includes handouts with suggestions for building your own disaster kit.
Regulatory Reference:	Optional course.

Personal Emergency Preparedness-EHS-5090	
Course Description:	Optional Class: Learn how to prepare yourself, your family and your home to survive the next disaster. You will receive information on emergency kits, family preparedness plans, fire safety, earthquake preparedness, and more. Learn about other opportunities and resources for improving your disaster preparedness and emergency skills. An emergency backpack or software kit is included upon completion of class.
Regulatory Reference:	Optional course.

Spill Prevention Control and Countermeasure-EHS-5100	
Course Description:	Oil Spill Response provides instruction to employees and others who handle oil in quantities exceeding 55 gallons. Enables oil handlers to safely respond to oil spills including protective measures, initial response, notification, and recordkeeping.
Regulatory Reference:	40 CFR Part 110 Section 112.7: http://www.epa.gov/OEM/docs/oil/spcc/guidance/B_40CFR110.pdf

Safety Training for Dining Bargaining Unit-EHS-5150 (On-Demand)	
Course Description:	This course covers custom Tier III training for R&DE staff based on specific request by R&DE management.
Regulatory Reference:	

Orientation for Lab Safety Coordinators-EHS-5200	
Course Description:	Training for lab safety coordinators and lab managers. Provides information on how to conduct and coordinate lab health and safety tasks assigned by lab manager or PI.
Regulatory Reference:	University policy

Working Safely near Radioactive Materials-EHS-5275	
Course Description:	Working Safely Near Radioactive Materials explains how to work safely near others who are using radioactive materials.
Regulatory Reference:	Optional course.

Respirator Use and Fit Test-EHS-5300	
Course Description:	Respirator Use and Fit covers the purpose of respiratory protection. Proper fit, inspection, cleaning, disinfection, and storage of respirators.
Regulatory Reference:	Cal/OSHA 8 CCR 5144(c)(1): https://www.dir.ca.gov/title8/5144.html

Supervisor Health and Safety Training-EHS-5400	
Course Description:	This course informs Supervisors of their responsibility to prevent and respond to workplace injuries by implementing the Injury and Illness Prevention Program (IIPP) including training, reporting, identifying and correcting hazards, and keeping records.
Regulatory Reference:	8 CCR 3203(a)(7): https://www.dir.ca.gov/title8/3203.html

Tier III Chemical Safety Training-EHS-5500 (On-Demand)	
Course Description:	Tier III Training for Chemical Laboratories is a detailed evaluation and discussion about the hazards associated with the specific research operations in the lab requesting the training.
Regulatory Reference:	8 CCR 3203(a)(7): https://www.dir.ca.gov/title8/3203.html

FEMA Introduction to Incident Command System, ICS-100, for Higher Education-EHS-9100	
Course Description:	This class introduces the Incident Command System (ICS) & provides the foundation for higher level ICS classes. Content is focused on Higher Ed Institutions.
Regulatory Reference:	Optional course.

FEMA NIMS An Introduction : EHS-9700a	
Course Description:	The class introduces the National Incident Management System (NIMS). NIMS provides a template to enable various sectors to work together during domestic incidents.
Regulatory Reference:	Optional course.

FEMA National Response Framework, An Introduction : EHS-9800b	
Course Description:	The course introduces participants to the concepts and principles of the National Response Framework.
Regulatory Reference:	Optional course.