UNIVERSITY of HOUSTON
DEPARTMENT OF PUBLIC SAFETY
Environmental Health and Safety

2011 Annual Report

Environmental Health and Safety
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MISSION

The purpose of Environmental Health and Safety (EHS) is to support the University of Houston in its mission of higher education and research. The Department's efforts are directed at assisting the University in identifying environmental safety hazards and controlling such hazards through protective equipment, hazard mitigation methods, and program development.

Environmental Health and Safety will keep abreast of relevant regulatory requirements. Regulatory compliance will be achieved through clear communication of recommendations and interpretations regarding such regulations to the appropriate administrators within the University.

SERVICES PROVIDED

Training of the University Community

Training of the University's faculty, students and staff is a key responsibility of the department.

The courses offered and number of people trained is listed as follows:

<table>
<thead>
<tr>
<th>INSTRUCTOR-LED CLASSES</th>
<th>TOTAL TRAINED</th>
<th>ONLINE TRAINING COURSES</th>
<th>TOTAL TRAINED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological Safety</td>
<td>320</td>
<td>Asbestos Awareness</td>
<td>1</td>
</tr>
<tr>
<td>Blood Borne Pathogens</td>
<td>838</td>
<td>Blood Borne Pathogens Refresher</td>
<td>318</td>
</tr>
<tr>
<td>General Laboratory Safety</td>
<td>410</td>
<td>Environmental Compliance</td>
<td>2</td>
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<tr>
<td>Hazard Communications</td>
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<td>Hazardous Waste Procedures</td>
<td>5</td>
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<tr>
<td>Laser Safety</td>
<td>60</td>
<td>Indoor Air Quality and Mold</td>
<td>2</td>
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<tr>
<td>Radioactive Material Safety</td>
<td>67</td>
<td>Laser Safety Refresher</td>
<td>77</td>
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<tr>
<td>Respiration Protection</td>
<td>31</td>
<td>Radioactive Material Refresher</td>
<td>123</td>
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<tr>
<td>Survey and Wipe Test</td>
<td>20</td>
<td>X-Ray Safety Refresher</td>
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<tr>
<td>X-Ray Safety</td>
<td>93</td>
<td></td>
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<tr>
<td>Infectious Substance Shipping</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PI.tDNA Training</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asbestos Awareness</td>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrofluoric Acid Training</td>
<td>36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>2012</td>
<td>TOTAL</td>
<td>635</td>
</tr>
</tbody>
</table>
Collaborations with customer groups resulted in the adaptation of most of our instructor-led training programs for specific departments. In addition, EHS developed a specialized training course for the use of hydrofluoric acid, potentially a very dangerous chemical. More hazard-specific specialized safety training programs are planned.

**New Hire Orientation**

Safety training was incorporated into the Human Resources Department’s New Hire Orientation program for all new staff members.
Laboratory Safety

The scope of the FY11 laboratory safety program includes 202 Principal Investigators in 936 laboratories within 16 buildings on campus:

**Laboratory Types by Discipline**

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical Labs</td>
<td>242</td>
</tr>
<tr>
<td>Biological Labs</td>
<td>337</td>
</tr>
<tr>
<td>Radioactive Material Labs</td>
<td>274</td>
</tr>
<tr>
<td>Animal Care Labs</td>
<td>83</td>
</tr>
</tbody>
</table>

**Equipment Count**

- Chemical Fume Hoods: 350
- Biological Safety Cabinets: 168
- Safety Showers: 100
- Eyewashes: 488
Laboratory Audits

Audits of 95 Principal Investigators were conducted broken down by the following disciplines:

<table>
<thead>
<tr>
<th></th>
<th>P.I. Audits - FY 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chemical Hazards</strong></td>
<td>23 Audits, 64 P.I.'s</td>
</tr>
<tr>
<td><strong>Biological Hazards</strong></td>
<td>51 Audits, 51 P.I.'s</td>
</tr>
<tr>
<td><strong>Radiation Hazards</strong></td>
<td>21 Audits, 56 P.I.'s</td>
</tr>
</tbody>
</table>

Chemical Safety Standard Operating Procedures

Most large research universities have a Chemical Safety Committee. In an effort to mitigate the lack of such a committee at the University of Houston, EHS began a program to help laboratory personnel develop Standard Operating Procedures for the use of hazardous chemicals. Forty-nine (49) Standard Operating Procedures (SOPs) were prepared during the year, 25 of which were in support of Animal Care Operations. Several of the SOP's were completed for common laboratory processes and are being implemented in a number of laboratories. This program significantly impacts the safety of work practices in laboratories. Using current chemical inventories, and through participation in the Institutional Animal Care and Use Committee, EHS will continue to develop this program.

Radiation Safety

EHS maintains safe radiological conditions to ensure the safety of students, faculty, staff and members of the public and compliance with all applicable regulations. This is accomplished through the integration of safety education, provision of health physics services, technical consultation as well as oversight. Implicit in all aspects of radiation safety program is security. The Radiation Safety Officer, along with the Radiation Safety Committee, continues to license and register all use, users, and use locations, to ensure controlled access to the purchase and use of radiation producing sources and devices.
Key radiation safety program metrics from FY 09 to FY 11.

A total of 50 packages, representing a 92% increase over the FY 09, were approved for purchase, received, surveyed and delivered to end users on campus. Inventories of all radioactive material as well as leak testing on sealed sources were performed on schedule. EHS continues to coordinate calibration of survey meters on behalf of approved users and this year, a total of 50 meters, representing a 19% increase over FY 09 were calibrated. Consistent with UH license and registration conditions as well as the regulatory philosophy of maintaining radiation exposures as low as reasonably achievable (ALARA), personnel and use location are monitored for radiation exposures. A total of 353 badges (134 whole body, 108 ring and 111 area/public dose monitors) were distributed during the period, an increase of 18% over the FY 09 figures.

To ensure compliance with license conditions, survey and wipe tests were performed on 244 use locations. EHS also performed 516 compliance reviews on monthly radioactive material laboratory surveys and wipe tests documentation from use locations.
Training on the survey and wipe process was developed and provided, as well as a spreadsheet automating reporting of surveys and wipe test data. This initiative earned the employee the “Employee of the Month Award” within the Department of Public Safety for March 2011.

Other services provided to ensure safety and compliance include:

- Facilitated the disposal of the radiographic x-ray unit formerly at the UH Health Center.
- Coordinated to ensure Physician oversight of the Bone Densitometer at the Health Human Performance Department was provided after the retirement of the former medical practitioner.
- Assisted tenant at the Energy Research Park regarding commencement of radiation related research activities. This initiative is ongoing with the hope of completing registration requirements in FY 12.
- To help prepare the Engineering Y-Building for demolition, EHS assisted with the relocation of registered devices and the disposal of radioactive material at the building.

Internal Process Improvements: Key to an effective and efficient program is ensuring internal processes effectively address customers’ expectations, addressing program’s safety and compliance objectives.

- Collaboration with other compliance committees started in the prior year was further strengthened.
- Security of licensed sources and registered devices at Science & Research I Building was threatened by the ongoing renovation. A protocol with stakeholder participation to address the issue as well as ensure contractor and public safety was developed and implemented.
- Radioactive material shipping request form was developed and put to use to provide guidance to researchers with need to ship hazardous samples to collaborators at other institutions.
- Magnet safety policy was developed to provide guidance to researchers using strong magnetic fields.
- Standard Operating Procedures were developed for certain use locations with x-ray and lasers as a best practice and satisfying regulatory requirements.
- A procedure to maintain compliance at multiple user work areas was implemented at a radioactive material use location within the SERC building (Center for Nuclear Receptor & Signaling.)

Radioactive waste management: Prudent management of radioactive waste continues with decay-in-storage and sanitary disposal of deregulated waste. Offsite disposal of long-lived radioisotopes as well as liquid scintillation vials was not performed during the period. Minimization of radioactive waste is achieved through education and routine review of laboratory processes and practices at point of generation, to ensure only radioactive contaminated lab ware and supplies are collected in radioactive waste bins. We also continue to monitor and coordinate the disposal of used x-ray tubes through the hazardous waste vendor because of the beryllium contamination.

Radiation Safety Committee: The Radiation Safety Committee, the Radiation Safety Officer, and the Division of Research work together as required by the Texas Department of State Health Services to oversee the Radiation Safety Program. As part of the annual review of the Radiation Safety Program, the Radiation Safety Officer reports about special projects, radiation incidents, and highlights of routine radiation safety activities to
the Committee. The Radiation Safety Officer also drafts the regulatory required annual report of the Committee activity that must be reviewed by senior university administration.

**Biological Safety**

The University of Houston researchers receive funding from various sponsors to conduct research involving biological hazards including potential human, animal or plant pathogens, recombinant DNA, select agents and toxins, as well as, any material requiring a import license from the Centers of Disease Control. UH researchers conduct this research at various buildings on the main campus and at the Texas Medical Center. Biological research laboratories currently comprise 46% of the university’s research laboratories, an increase from 24% in FY 09. A biological safety specialist was added to staff in FY11 to serve this increase. A few major contributors to this growth are the addition of research centers, such as the Center for Nuclear Receptors and Cell Signaling, a change in research dynamics which resulted from the Division of Research’s “Cluster” initiative and increasing research complexity with the emergence of work with recombinant viral vectors. EHS expects this trend to continue with the addition of the new Health and Biomedical Science Center, Science Teaching Laboratory and completion of the remaining floors in the Science and Engineering Research Complex.

**Institutional Biosafety Committee:** The Institutional Biosafety Committee (IBC) is a requirement of the National Institutes of Health (NIH). The IBC ensures that research conducted at UH is in compliance with NIH Guidelines for Research Involving Recombinant DNA, CDC Select Agents Rule, the Biosafety in Microbiological and Biomedical Laboratories, as well as institutional biosafety policies and procedures. The current IBC roster includes representatives from the departments of Biology & Biochemistry, Biomolecular & Chemical Engineering, Optometry, Pharmacological and Pharmaceutical Science, Animal Care, Division of Research, Environmental Health & Safety, Office of General Counsel, University of Houston Downtown and non-institutional representation.

The Institutional Biosafety Committee met three times to review and approve 28 Memorandums of Understanding and Agreement (MUAs). In addition, seven amendments to previously approved MUAs were approved following review by the Biological Safety Officer. Currently there are 82 registered Principal Investigators and a total of 112 active projects of which 31 are at Biosafety Level 1 (BSL-1), and 81 are at Biosafety Level 2 (BSL-2). This shows an increase in biological research complexity.
Biological Safety Memorandums of Understanding

Bloodborne Pathogen Program: The Bloodborne Pathogens Program is a requirement of the Texas Department of State Health Services to address occupational exposures to Bloodborne pathogens. There were significant enhancements to this program including an expansion of departments participating in the program, expanding customization of training to five versions, and administrative improvements in preventive measures through vaccination.

Animal Care Operations and the Institutional Animal Care and Use Committee Support: EHS participates in membership of the Institutional Animal Care and Use Committee (IACUC) and provides expertise in safety risk assessments. Committee meetings were attended and 209 protocols were reviewed. EHS participated in two semi-annual inspections of the animal facility and animal research laboratories, resulting in 83 inspections. EHS consulted with Animal Care and provided operational and facility design recommendations.

Consultative and Technical Support

EHS provided consultative support to assist new principal investigators with orientation and laboratory setups. Technical support was also provided for various research projects and experimental operations. In addition, special research involving the use of radiation was conducted by University faculty and students at national laboratories and international facilities with specific authorizations and support provided as requested by these institutions.
Eyewash and Safety Showers

EHS conducted a comprehensive evaluation of the adequacy of safety showers and emergency eyewashes serving University laboratories. The evaluation identified the need to install 87 new fixtures based on distances of existing fixtures to laboratories and the need to repair 14 fixtures. EHS worked with Facilities Management to facilitate completion of all needed repairs and development of a comprehensive proposal to add fixtures where needed for presentation to the Capital Renewal and Deferred Maintenance Committee.

Visiting Researcher and Minor Procedures

Policies and procedures for visiting researchers and minors were developed. This was an effort by the department in collaboration with the Division of Research and the Office of the General Counsel. The policy ensures necessary training and monitoring of the visitors.

Hazardous Waste Management

The Environmental Protection Agency (EPA) is the federal agency that establishes minimum regulations for waste, and the Texas Commission on Environmental Quality (TCEQ) regulates the disposal of waste generated at the University. Depending on the classification of the waste, there are significant requirements that must be met. The University continues to expand its research and teaching activities which leads to the increased generation of regulated waste material.

EHS maintains two buildings for the storage and disposal of waste: the Chemical Waste Building and the Radioactive Waste Building. Checklists are reviewed monthly for equipment maintenance and regulatory requirements. EHS must continually handle, repackage, and prepare waste for disposal by contractors.

EHS completed the following waste pick-ups from the main campus and the College of Pharmacy located in the Texas Medical Center (TMC):

- Chemical waste pick-ups 568
- Biological waste pick-ups 647
- Radioactive waste pick-ups 31
The biological waste vendor was changed early in FY11 and the current vendor's fees are 50% of the prior vendor's.
In addition to the chemical and biological waste, 100 grease and lint trap pump-outs were conducted throughout the main campus. The total amount of waste material was approximately 147,472 gallons. Several new traps were added and more traps are planned to come on line in FY12.

Environmental Protection

Pollution Prevention Activities

The University continues to generate a significant amount of hazardous waste per the TCEQ regulations and is classified as a large quantity generator. Hazardous waste is a subset of different types of chemical waste generated in campus laboratories, maintenance areas and auxiliary facilities. As a result of our large quantity generator status we are required to submit a Pollution Prevention Plan. As indicated in the graph below, EHS implemented a series of waste minimization initiatives in 2005 that took four years to fully implement. In more recent years, the waste generation increased significantly, consistent with the university’s growth in research awards.
EHS has developed a two-prong approach to address waste minimization effects on campus for the coming years. One approach is to promote waste minimization practices at the point of generation at the laboratory specific level. The other approach is to minimize the quantity of waste shipped off site for disposal as much as possible. Each of these approaches and potential benefits will be discussed individually.

With over goo laboratories now and more currently under construction, two newsletter articles were sent for distribution to the Academic and Research faculty members in May 2011. One article suggested methods to reduce chemical waste in an academic setting and the other in a research setting. These newsletters were well received and EHS plans to provide future similar articles for the laboratory community.

EHS met with 15 Principal Investigators identified as high volume lab pack drum waste generators based upon a six-month review of recent waste disposal data. The goal was to identify potential methods to reduce the generation of lab pack waste.

Chemical waste of all types is picked up and brought to the EHS waste facility. Hazardous waste is generally shipped out in either a lab pack drum (sometimes called an overpack) or a bulked drum (see picture below)

![Lab pack drum (blue) bulked waste drum (white)](image)

The lab pack drum (blue) contains individual waste containers packed with an absorbent material and the bulked drum contains just the contents of the waste containers.
The crucial difference in lab pack waste versus bulk waste is in the disposal costs. While each drum and all its contents above are considered hazardous, the lab pack drum holds much less in waste quantity than a bulked drum. Therefore bulked drum disposal is 90% more cost effective than lab pack disposal.

One of the steps that EHS has taken to enhance bulking is the planned addition of a new walk in fume hood for the waste facility. This new fume hood which is scheduled for installation in late 2011 will provide greater protection for EHS waste personnel by having more shielded space as they bulk more compounds. This will allow EHS to bulk acid waste, which has thus far been disposed of in lab packs.

**Occupational Safety**

**Asbestos Containing Materials**

EHS secured a new position in late November 2010 for an Asbestos & Safety Coordinator. The University has Asbestos Containing Materials (ACM) in approximately half of the building on campus. The initial focus of this position was to assess and improve the University’s current level of compliance with ACM regulations.

The Asbestos & Safety Coordinator developed new documents such as the ACM Management Plan, checklists, and the Operations and Maintenance Plan. These are now used by Facilities Management and Facilities Planning and Construction project managers to assure compliance with ACM rules.

Another key focus point for this position was the improvement of our current recordkeeping procedures for ACM in buildings. Many of our existing buildings had multi-year gaps in historical records of asbestos related documents. The Asbestos & Safety Coordinator solicited ACM information as he became more involved in renovation, demolition and construction projects. Previously unknown ACM abatement documentation has been identified and added to the records. Concurrent with these efforts the most current surveys of ACM locations in buildings have been updated.

After developing a new asbestos awareness training presentation, 11 sessions were presented to 90 employees in Facilities Planning & Construction and Facilities Management. These personnel were identified as the most likely to disturb ACM in the course of their job functions.
In effort to determine the effectiveness of the new ACM procedures and checklists, EHS conducted a survey in the spring of 2011. Based upon the project status reports from Facility Planning & Construction and Facilities Management personnel, EHS discovered approximately 28% of the time the appropriate checklists and procedures were being followed. After communications from EHS to these departments, in August 2011 compliance with the appropriate procedures improved to over 90% compliance and two months later compliance was at 100%.

**Indoor Air Quality Service**

IAQ complaints comprise the bulk of incident investigations performed by EHS. In FY11, IAQ surveys were performed at Science and Research I, Bates Law Center, and the College of Architecture. In addition, mold sampling contracts were secured by EHS for surveys in the Bayou Oaks and the College of Architecture. There was also a survey for the Charter School located in Melcher Gym that was undertaken to assess chlorine levels in the vicinity of the pool.

**Construction Support**

EHS became heavily involved in the planned research expansion at the Energy Research Park (ERP). One of the major initiatives is a new solar research laboratory in building 15 of the park and an affiliated commercial venture in building 14. EHS expects both of these planned facilities to become operational in FY12. EHS began working towards registering the ERP as a separate site for environmental compliance.

EHS also performed plan reviews on the Science Teaching Laboratory, SERC build out, Classroom and Business Building, Communications Building, and Health and Biomedical Science Center and provided regulatory comments as needed.

**Management of Consulting Projects**

EHS began managing safety and environmental consulting projects on behalf of Facilities Planning and Construction (FPC) and Facilities Management (FM) in FY11. This is a more efficient process than the prior method of interfacing with the FPC or FM Project Managers during the projects. An added benefit was transmission of the consulting report with concise summaries and recommendations.

**Occupational Shop Safety**

In FY11, EHS began a shop safety program applicable to all shops across campus, including academic facilities. Three (3) shop audits were conducted in FY11. These included the Lock Shop and Skilled Trades Shop in the General Services Building and the Architecture Shop building. EHS hopes to grow this program and in the
coming years through a combination of program development and training. After the first few audits it became apparent that many general safety programs (such as fall protection and lock out tag out) are not standardized throughout the University. There are gaps in training, standard operating procedures and equipment need to maintain effective programs. EHS will work towards building the foundation for a stronger program in FY12.

Climbing Wall at Recreation Center

In FY11, EHS consulted with Facilities Management and Campus Recreation personnel in developing new standardized procedures to maintain the safety and integrity of the climbing wall. There were concerns expressed over former operational procedures and the wall was temporarily closed. However, after multiple collaborative efforts with EHS and others, the wall is now open. There are standard operating procedures and a maintenance schedule in place.

Ergonomic Work Station Evaluations

EHS was able to perform five (5) workstation evaluations in FY11. Recommendations were made in the purchase of keyboards, chairs and other equipment to improve employee after reviewing the employee’s specific set up. All of the evaluations showed some success after the recommendations were acted upon.

Incident Response

Eighty-five (85) incidents entered into the Facilities Management work order system were directed to EHS in FY11. Fifty-four (54) incidents were indoor air quality (IAQ) related concerns including various types of odors, abnormal temperatures or humidity, dirty air vents, and asbestos concerns. Eighteen (18) incidents included water leaks or mold concerns. The remaining incidents included eight (8) laboratory related incidents (fires, mercury spills, fume hood problems, chemical spills) and five (5) general safety incidents (oil or gas spills in parking lots, trip hazards, hazardous substance in elevator).
Employee Accidents

One hundred fifty two (152) workers' compensation claims were filed with Risk Management. The University's claims are administered through the State Office of Risk Management. One hundred two (102) of those claims were filed with the carrier due to medical treatment sought and lost time from work. Thirteen (13) were denied, 67 resulted in lost time, and 35 were resolved without lost time. The most frequent types of injuries were contusions and strains and sprains. This has consistently been the case during the past several years. The breakout of claims by type of injury and occupation are as follows:
Regulatory Affairs

Environmental Protection

The following required reports were submitted on behalf of the University:

- Stage II Vapor Recovery Exemption Report. The University can claim an exemption from vapor controls on the gasoline pump itself (known as Stage II Vapor Control) if less than 10,000 gallons is pumped per month.
- Texas Tier II report. This is an inventory of hazardous chemicals for emergency planning purposes.
- Annual Waste Summary for College of Pharmacy (TMC) and the main campus. This is a summary of regulated waste generated at both locations.
- Underground Storage Tank Registration & Self Certification form. This is an annual report for underground storage tanks at General Services and Police.
- The Nitrogen Oxides (NOx) Cap and Trade report. This is a summary of NOx emissions from the main campus.
- Pollution Prevention Progress Report. This is required for the main campus due to our large quantity status as a generator of hazardous waste status.

City of Houston Environmental Investigators made two trips to the main campus concerning grease traps in FY11. They were interested in several grease traps that EHS had earlier not been aware of the operational status. Six traps and two lift stations were added in FY11.

EHS coordinated air emission stack testing for the Campus Recreation and Wellness Center boilers. Although, some stack testing data was used as a basis for emission estimates for oxides of nitrogen (NOx), the TCEQ requested a standardized stack test protocol.

EHS also submitted a new standard permit application for the Central Plant Boilers in late FY11. The new boilers will be ultra-low NOx emitters and should place the University well under its air emission limit.

Controlled Substances & Dangerous Drugs

EHS management of research use of Controlled Substances and Dangerous Drugs was discontinued following a United States Drug Enforcement Agency’s (DEA) directive. In FY 11, EHS managed the phase-out of the program to afford registrants time to change registration addresses. The university policy on Clinical and Research Use of Controlled Substances and Dangerous Drugs, MAPP 06.04.01 was revised during the period to comply with the DEA directive. EHS will assist DEA registrants at the university with compliance reviews as contained in the policy.
Radiation Safety

The Radiation Safety Officer maintains the Radioactive Material Broad License, the X-ray Registration, and the Laser Registration with the Texas Department of State Health Services for the University. Amendments must be submitted to Texas Department of State Health Services to make technical, procedural and administrative changes. This year the Radioactive Material Broad License was amended to reflect the changes in the Radiation Safety Committee Membership and is current until March 31, 2013. The X-ray Registration was amended for changes in X-ray machines numbers & categories as well as change in Radiation Safety Officer and is current until June 30, 2015. Reporting and monitoring of special nuclear material listed with the Nuclear Materials Management Security System (NMMSS) is ongoing.

The Texas Department of State Health Services routinely makes changes to the radiation regulations which may impact the Radiation Safety Program administratively, operationally, and procedurally. The Radiation Safety Officer attends stakeholders meetings and makes comments for the University on significant proposed legislation of radiation regulations. The Radiation Safety Officer also receives confidential notices from the Nuclear Regulatory Commission prompted by the Department of Homeland Security on the security of radiation sources and devices.

Biological Safety

The National Institutes of Health has instituted a Site Visit Program to verify compliance with its guidelines for Institutional Biosafety Committees.
PROFESSIONAL DEVELOPMENT OF EHS STAFF

Since environmental health and safety is a highly regulated technical area, professional development of staff is critical for maintenance of sufficient competence. In prior years, a significant portion of EHS’s operational budget has been dedicated to professional development. Financial constraints and a ban on out-of-state travel caused a significant reduction in professional development of staff, particularly in the areas of biological safety and radiation safety. Formal training participation during FY11 is as follows:

**Biological Safety**
- Genomic Webinar (3 employees)
- ABSA Certification Review Course (1 employee)

**Chemical Safety and Hazardous Waste**
- RCRA Hazardous Waste Training (5 employees)
- HazWoper Online Training (2 employees)
- Introduction to Nanomaterials & Occupational Health Southwest Center for Occupational and Environmental Health (1 employee)
- Hazardous Waste Refresher Training (2 employees)
- Texas Hazardous Waste Regulations (2 employees)
- Asbestos Consultant Level License Refresher Professional Environmental Training (1 employee)
- Chemical Waste Practices Review (2 employees)
- Hazardous Waste Management per USEPA and Texas Rules (2 employees)

**Radiation Safety**
- Texas Radiation Regulatory Annual Conference (1 employee)
- Laser Institute Conference (1 employee)

**Miscellaneous**
- National Incident Management System ICS 100, 200, 700, 800, 300 and 400 Training
- Asbestos Refresher Course (1 employee)
- Construction Safety Regulation Online Training (1 employee)
- OSHA Refresher Online Training (1 employee)
- Oil Spills, Deepwater Spills & Spill Response Seminar (1 employee)
- Safety and Error Prevention Symposium (1 employee)
The Department’s staffing is less than that of peer institutions considering the enrollment, total square footage and square footage of laboratory space. Therefore, the department needs to prioritize the services it provides and cannot perform all services typically performed by similar departments at many other large research universities. The department’s emphasis is in the area of research support, specifically laboratory safety, with few resources dedicated to other aspects of environmental health and safety. This is necessary because of the significance of the hazards of chemicals in laboratories and the degree of regulation in radiation safety and biological safety.

Key challenges are:

**Regulated Waste**
- Verification testing on autoclaves used for biological waste to ensure they are operating properly
- Audit construction and renovation project waste disposal practices for compliance
- Identify and charge back contractors who leave regulated waste behind for disposal
- Regularly audit the University’s waste vendors and recyclers facilities for compliance

**Air Emissions**
- Audit the run meters on the emergency generators for accuracy
- Audit refrigerant use and recovery methods around campus

**Chemical Inventory**
- Institute a chemical tracking system to secure a high level of confidence in the University’s chemical purchase and storage practices and lead to more detailed Tier II inventory report

**Indoor Air Quality (IAQ) Concerns**
- Proactively test for potential IAQ problems

**Storm Water**
- Monitor for storm water excursions during major events
- Audit individual storm water pollution prevention plans of construction projects
Radiation Safety

- Laser Safety Program implementation
- Process automation technology for routine duties
- Staff retention
- Professional Development

Biological Safety

- Develop and implement Contaminated Sharps Injury Log program
- Electronic protocol routing and submission
- Greater collaboration with the Purchasing Department for biological agents
- Professional Development
- Identification of new faculty and research

Chemical Safety

- Perform industrial hygiene monitoring of hazardous chemical use
- Complete an annual audit cycle for chemical laboratories

Occupational Safety

- Inspection and auditing of non-laboratory space
- Job safety analysis and ensuring that the proper safety equipment is available for the trade occupations
- Development of a comprehensive occupational health program including the involvement of Environmental Health and Safety, Department of Animal Care and a health care provider such as the Student Health Center.
GOALS

FY 12

Biological Safety
- Convert instructor-led Biological Safety training quiz to delivery through Blackboard
- Convert the Bloodborne Pathogens training quiz to delivery through Blackboard
- Convert Bloodborne Pathogens online training to Blackboard delivery
- Streamline Biosafety protocol review process
- Revise the Biosafety Manual
- Revise the Biosafety Website

Radiation Safety
- Update the Laser Safety instructor-led training

Chemical Safety
- Develop and present a hazardous compressed gas training course for compressed gas users
- Convert the General Laboratory Safety quiz to delivery through Blackboard

Environmental Protection
- Coordinate stack testing for new boilers in Central Plant and Biomedical facility and adjust annual reporting procedures accordingly to comply with Cap and Trade program
- Convert the Environmental Compliance online training program to Blackboard delivery

Occupational Safety
- Prepare program material for Fall Protection
FY13 – FY14

**Staff Increases**

- Add an Occupational Safety Manager, a Safety Specialist for occupational safety, and a Hazardous Waste Specialist to staff during FY13. This will allow the department to sufficiently develop its occupational safety and health programs. The Hazardous Waste Specialist will allow the Safety Specialist (who currently spends most of his time picking up hazardous waste) to primarily focus on chemical laboratory audits and development of chemical Standard Operating Procedures.
- A Safety Specialist to focus on biological safety should be added to staff in FY14 to service the expected expansion of biological and biomedical research.

**Data Management**

- A comprehensive data management system should be purchased in FY13 to automate and streamline recordkeeping demands. This will allow the time of technical specialists to be shifted away from extensive administrative work, increasing productivity.

**Chemical Safety**

- Identify and assess safety practices in laboratories using Nanomaterials or extremely hazardous substances
- Convert Instructor-led Hazard Communication training quiz to online delivery through Blackboard

**Biological Safety**

- Implement e-Protocol submissions and routing
- Revise Biological Safety training

**Radiation Safety**

- Convert the three online training courses to Blackboard delivery
- Convert instructor-led Radiation Safety training quizzes to delivery through Blackboard

**Environmental Protection**

- Disposal of at least 70% of liquid chemical waste in bulk containers versus lab over packs
- Convert the Indoor Air Quality online training program to Blackboard delivery
• Convert the Hazardous Waste online training program to Blackboard delivery

**Occupational Safety**

• Expand the general safety shop audits program
• Develop Lock Out /Tag Out Program
Benchmarking of Programs

Benchmarking studies were completed for the chemical waste program, radiation safety program and the biological safety protocol approval process. The benchmarking studies compared the three programs to large research peer institutions. The benchmarking reports follow this summary.

The chemical waste program is similar to those of peer institutions with respect to tons of waste generated compared to research funding and EHS staff ratios per tons of waste generated. Peer institutions bulked more of its waste verses lab pack disposal. Subsequent to the completion of the study, a decision was made to install a new and improved fume hood to allow acidic waste to be bulked safely.

The radiation safety program benchmarking study indicated that staffing levels are adequate. Administrative support, technological systems and professional development of staff are below industry norms.

The biological safety protocol approval process comparison indicated that the content and methodology used is similar to that of the peer institutions. Administrative support, technological support, MUA approvals and professional staff development are below the norms of the peer institutions.
Chemical Waste Benchmarking

Background

The University currently has ~800 laboratories divided among 12 major laboratory buildings. There are two new laboratory buildings planned within the coming two years that will add an additional 100,000 square feet of laboratory space. The University is also pursuing the development of an Energy Research Park located on an adjacent property. The expansion of scientific research is expected to increase the amount of hazardous waste generated.

Currently the University is classified as a large quantity generator under the Texas Commission on Environmental Quality (TCEQ) hazardous waste regulations and is subject to all applicable requirements. Large volumes of hazardous materials are required in order to conduct research, provide hands-on teaching experimentation and maintain the University’s physical plant. While efforts are made to reduce, recycle and reuse these hazardous materials, much of it is ultimately being disposed of as hazardous waste. The University is committed to reducing both the amount of hazardous waste and the associated disposal costs, as much as possible.

Environmental Health and Safety (EHS) manages chemical wastes for the campus. Hazardous waste, which is a subset of chemical waste, is managed in the EHS hazardous waste facility. Most of the hazardous waste generated on campus, typically 85 – 90 percent, comes directly from a research laboratory or support area. The disposal cost is paid by the Division of Research.

In an effort to benchmark chemical waste generation processes, EHS contacted several peer institutions. These institutions are University of Texas at Austin (UT), Texas A & M University (TAMU), Texas Tech University (TTU) and the Baylor College of Medicine (BCM) in the Texas Medical Center.
Waste Activities

The following is a graph of chemical waste activities for calendar year 2010 for UH and the four other peer institutions.

![2010 Chemical Waste in Tons](image)

UH is close to Texas Tech in terms of chemical waste generation. However, the other three institutions generate several times more chemical waste at this time than UH.

The various institutions staffing levels for chemical waste handling and research funding levels were compared. The following table describes this comparison:

<table>
<thead>
<tr>
<th></th>
<th>UH</th>
<th>UT</th>
<th>TAMU</th>
<th>TTU</th>
<th>BCM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff devoted to chemical waste</td>
<td>1.3</td>
<td>4.0</td>
<td>4.0</td>
<td>1.5</td>
<td>5.0</td>
</tr>
<tr>
<td>Total Funded Research in Millions</td>
<td>$114</td>
<td>$642</td>
<td>$623</td>
<td>$67</td>
<td>$302</td>
</tr>
<tr>
<td>Staff per 10 tons of waste generated</td>
<td>0.6</td>
<td>0.3</td>
<td>1.6</td>
<td>0.6</td>
<td>0.7</td>
</tr>
<tr>
<td>Tons of waste Per 100 Million Dollars of Research</td>
<td>19.3</td>
<td>19.1</td>
<td>10.3</td>
<td>41.8</td>
<td>22.5</td>
</tr>
</tbody>
</table>
UH's expected increase in research will likely see a corresponding increase in chemical waste generation. Therefore any steps that can be taken to reduce waste at the point of generation (laboratories) or improve efficiencies in disposal methods will be beneficial.

**Bulking**

One method that all institutions use to minimize chemical waste is combining compatible liquid waste into a single drum versus packing individual containers along with some absorbent packing material. This is referred to as bulking.

Note the drum on the left (blue) is a lab pack drum and the drum on right (white) is a bulked drum. The disposal cost (per drum) of lab pack waste is much more expensive than bulked waste. According to regulatory guidelines, the entire drum is deemed hazardous waste. Since a bulked drum can hold much more waste than a lab pack drum, it is much more cost effective.

In discussions with our peer institutions there is a range of containment equipment, personal protective equipment, standard practices and procedures used to safely bulk chemical waste. The chief concern is prevention of an unexpected reaction to occur while bulking.
The following table is a summary of the different procedures, personal protective equipment (PPE) and containment equipment used for the bulking process at peer institutions.

<table>
<thead>
<tr>
<th>Institution</th>
<th>UH</th>
<th>UT</th>
<th>TAMU</th>
<th>TTU</th>
<th>BMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of bulking</td>
<td>Modified fume hood</td>
<td>Walk in fume hood</td>
<td>Slot fume hood</td>
<td>Floor to ceiling fume hood</td>
<td>High Flow Local Exhaust</td>
</tr>
<tr>
<td>Pre bulk Activities</td>
<td>Generator knowledge</td>
<td>Generator knowledge</td>
<td>Generator knowledge</td>
<td>Generator knowledge</td>
<td>Generator knowledge</td>
</tr>
<tr>
<td>Pre Bulk Tests</td>
<td>pH and test buckets at discretion of staff</td>
<td>Mandatory pH checks</td>
<td>pH and test buckets at discretion of staff</td>
<td>Mandatory pH checks before bulking</td>
<td>pH and test buckets at discretion of staff</td>
</tr>
<tr>
<td>Protective Clothing used</td>
<td>Smock or lab coats, gloves, safety glasses or goggles or shield</td>
<td>Smocks, tyvek suites, gloves,</td>
<td>Smocks, tyvek suites, gloves,</td>
<td>Lab coats, aprons, gloves, goggles or shields</td>
<td>Smocks, lab coats, aprons, gloves</td>
</tr>
<tr>
<td>Respiratory Protection</td>
<td>Full or half face respirator optional</td>
<td>Full face respirators</td>
<td>Full face respirators</td>
<td>Respirators optional</td>
<td>Supplied air line full face</td>
</tr>
<tr>
<td>Percentage of total waste bulked</td>
<td>57%</td>
<td>50%</td>
<td>85%</td>
<td>75%</td>
<td>Almost all liquid waste</td>
</tr>
<tr>
<td>Crush bottles used as waste containers</td>
<td>Yes</td>
<td>No longer crush,</td>
<td>Yes</td>
<td>No, deface and dispose in dumpster</td>
<td>No, dispose in broken glass boxes</td>
</tr>
</tbody>
</table>

Several common practices were identified in bulking operations. One is that all the others institutions bulk compatible chemicals and they all use some type of local ventilation at the bulking location. A proper type of walk-in fume hood provides the best protection for the employees. Another common practice is that each institution places a high value on their waste personnel's experience in identifying potential problems during bulking operations.

The chief reason bulking is a preferred waste minimization strategy is due to the disposal cost savings. In the University's current vendor contract for example, bulk liquid waste ranges from $54 per 55 gallon drum of flammable liquids up to $168 per 55 gallon drum of corrosive liquids for disposal. This is approximately $1 - $3 per gallon; whereas lab pack rates begin at $204 per container and they may hold only 5 gallons of waste material making the approximate cost $41 per gallon.
The following is a summary of chemical waste activities for the period August 2010 through February 2011 at the University.

**Items Handled at Pick-Up**

- Bulked: 1%
- Lab Pack: 1%
- Recycle: 1%
- Trash: 1%
- Bio: 7%
- Paint/Universal: 32%
- Unknown: 57%

*Research Only

**Handling & Disposal Cost**

- Bulk: $3,718.00
- Lab Pack: $4,975.36
- Paint/Universal: $4,205.20
- Cylinders: $98.95
- Trash: $475.20
- Dropped Materials: $8,756.47
- High Haz: $36,154.43

*Includes all cost centers

The charts above clearly illustrate the significant cost differences between lab pack and bulk waste disposal.
An analysis of waste generation was conducted. The table below shows the top generators (Principal Investigators) of waste overall and the top ten generators of lab pack waste, during the period of August 2010 – February 2011. Please note that this information has been adjusted to account for atypical waste activities (ex. lab cleanout) identified during this time.

<table>
<thead>
<tr>
<th>August 2010 - February 2011</th>
<th>Top Generators – Total Waste (Number of Pick-ups)</th>
<th>Top Ten Lab Pack Generators (Number of Items)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rappengluceck (19)</td>
<td>Santos (23)</td>
<td></td>
</tr>
<tr>
<td>Gilbertson (12)</td>
<td>Ignatiev (16)</td>
<td></td>
</tr>
<tr>
<td>Miljanic (11)</td>
<td>Alcantara (13)</td>
<td></td>
</tr>
<tr>
<td>Burns (9)</td>
<td>Burns (10)</td>
<td></td>
</tr>
<tr>
<td>Moeller (6)</td>
<td>Moeller (10)</td>
<td></td>
</tr>
<tr>
<td>Litvinov (6)</td>
<td>Vipulanandan (9)</td>
<td></td>
</tr>
<tr>
<td>Cai (6)</td>
<td>Lee (8)</td>
<td></td>
</tr>
<tr>
<td>Daugulis (4)</td>
<td>Willson (8)</td>
<td></td>
</tr>
<tr>
<td>May (4)</td>
<td>Gao (8)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hoffman (8)</td>
<td></td>
</tr>
</tbody>
</table>

**Nano Waste**

Nanotechnology is an emerging science at UH as well as our peer institutions. The challenge with nano particles and nano waste is that there are currently no recognized standards for exposure levels, handling and disposal. Unlike hazardous chemical waste, which is highly regulated through the Resource Conservation and Recovery Act (RCRA) by the Environmental Protection Agency (EPA) and TCEQ, nano waste is a newer type of waste, without sufficient data to effectively determine health hazards or control measures.

UH and Texas A&M bulk liquid nano waste while the other institutions dispose of liquid nano waste in its container inside an over pack drum.

Similarly the consensus is nano waste dust may be a greater hazard; however the nano particles quickly attach themselves to other materials and unless disturbed they remain in their medium.
Next Steps

Based on our benchmarking, it appears that the University should increase bulking of compatible wastes as a means to reduce waste disposal costs. Bulked waste is much less expensive to dispose of rather than lab pack waste. The greatest opportunity for improvement is with the aqueous waste streams. However, since they involve acids or bases, there is an increased risk of inhalation hazards and unexpected reactions. Therefore opportunities to bulk aqueous waste and associated safety controls will be evaluated.

Another approach is to reduce chemical waste generation at the source (in the laboratories). This is more challenging; however, it may yield significant results. For example, by analyzing the types of chemicals that are used in the laboratory and the purpose for which they are intended, alternative chemical products that will yield the same results but with considerably less disposal cost may be identified. Further, modification of experiment protocols could offer an additional reduction in waste generation and/or hazardous properties of chemical waste generated in the laboratories. This initiative will be directed toward the top ten generators of lab pack waste.
UNIVERSITY OF HOUSTON
RADIATION SAFETY PROGRAM BENCHMARKING REPORT

The University of Houston (UH) maintains a Broad License for radioactive material and a Certificate of registration for radiation producing machines/devices (x-ray and laser). Several researchers conduct radiation related research at various buildings on the main campus and at the College of Pharmacy, Texas Medical Center. Requests for proposed use of radiation sources have been received at the Energy Research Park and use is also anticipated at the upcoming Biomedical Complex. The Radiation Safety program is administered by Radiation Safety personnel (Radiation Safety Manager/Radiation Safety Officer- RSO, Assistant Radiation Safety Officer- ARSO and Radiation Safety Specialist) within the Environmental Health and Safety (EHS) department. Program oversight is received from the Radiation Safety Committee.

In an attempt to address the University of Houston’s Radiation Safety program staffing levels, the report will benchmark program workload/processes at UH with peer institutions. Staffing models at peer institutions will also be compared to UH’s Radiation Safety program staffing model. The current staffing, position titles and salary levels will also be reviewed in comparison with peer institutions. Compliance status of UH radiation safety program will also be presented and conclusions from the benchmarking process. Recommendations towards improving UH’s program will be made where necessary.

Survey methodology: Academic institutions with similar scope (or higher) of radiation-related research activities (mostly in Texas) selected for this benchmarking include Texas A&M University, College Station. (Texas A&M), University of Texas, Austin (UT-Austin), University of Houston Health Science Center, Houston (UTHSC-Houston) and Colorado State University,
Fort Collins. (CSU, Fort Collins). A questionnaire (Appendix A) was sent to the program managers and/or Radiation Safety Officers at the institutions surveyed. The EHS website of related institutions was also reviewed and follow up phone calls were made to obtain clarification on certain items. In certain cases, additional information was obtained to assist with benchmarking. Salary information for public institutions in Texas was obtained from The Texas Tribune at http://www.texastribune.org/library/data/government-employee-salaries/. The website has a database with information on government employee salaries for Texas. Salary information from Colorado State University, Fort Collins was not obtained. The results of the benchmarking will be discussed in the following section.

**Program Staffing Model Benchmarking:**

<table>
<thead>
<tr>
<th>UT-HSC Houston</th>
<th>UT-Austin</th>
<th>Colorado State University</th>
<th>Texas A&amp;M</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSO/AVP-Research</td>
<td>RSO/Asst EHS Director</td>
<td>RSO/Manager</td>
<td>RSO/Manager</td>
</tr>
<tr>
<td>Manager/ARSO</td>
<td>Manager/ARSO</td>
<td>Safety Specialists/HP</td>
<td>Safety Specialists/HP</td>
</tr>
<tr>
<td>Safety Specialists/HP</td>
<td>Safety Specialists/HP</td>
<td>Health Physics Tech</td>
<td>Health Physics Tech</td>
</tr>
<tr>
<td>Administrative Assist</td>
<td>Health Physics Tech</td>
<td>Administrative Assist</td>
<td>Administrative Assist</td>
</tr>
</tbody>
</table>

**Table II: Program Staffing levels at UH**

<table>
<thead>
<tr>
<th>U of H</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSO/Manager</td>
</tr>
<tr>
<td>ARSO</td>
</tr>
<tr>
<td>Safety Specialists/HP</td>
</tr>
</tbody>
</table>

The staffing model from other institutions is displayed in Table I and the staffing model at UH is shown in Table II.
At some institutions (Texas A&M and Colorado State University), the Radiation Safety Officer (RSO) also serves as the Program Manager while at others (UT-HSC Houston and UT-Austin) the RSO is different from the Program Manager. At UT-HSC Houston and UT-Austin, the Assistant RSO serves as the Program Manager, obtaining regulatory support and oversight from the RSO, who in all programs benchmarked is a higher ranked university employee or administrator. For example, at the UT-HSC Houston, the RSO also serves as the Vice President of Safety, Health, Environment & Risk Management. At UT- Austin, the RSO is also an Assistant Director within the EHS Department. The Radiation Safety Officers at UT-Austin and UT-HSC Houston have previously served as Radiation Safety Officers/Program Managers and they currently assist the Program Manager/ARSO in regulatory as well as institutional issues.

From the review, the current staffing model at the University of Houston is different from other institutions reviewed. Please note that the University of Houston’s staffing model was similar to Texas A&M and CSU, Fort Collins until July 2010. The staffing models at CSU, Fort Collins and Texas A&M are very typical of emerging programs to allow time for experienced RSOs to advance within the university system to be able to transition towards the models currently used at UT-HSC Houston and UT-Austin. Whereas the benefits of separating program management from regulatory oversight reinforce the checks and balances emphasized by regulatory agencies, having a senior ranking university administrator in the RSO capacity is one benefit which cannot be overstated. These individuals have served the program before and are currently providing program continuity, regulatory support and institutional resource advocacy.
Workload Benchmarking:

Table III: Measurable Programmatic Radiation Safety Items

<table>
<thead>
<tr>
<th></th>
<th>UH</th>
<th>UT-AUSTIN</th>
<th>UTHSC-HOUSTON</th>
<th>TEXAS A&amp;M</th>
<th>CSU, Fort Collins</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL (FULL TIME) PERSONNEL</td>
<td>3</td>
<td>4.5</td>
<td>6</td>
<td>4*</td>
<td>5.5</td>
</tr>
<tr>
<td>LASERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regulated lasers (Class IIIb &amp; IV)</td>
<td>121</td>
<td>400</td>
<td>59</td>
<td>272</td>
<td>50</td>
</tr>
<tr>
<td>Authorized Users (PIs included)</td>
<td>39</td>
<td>85</td>
<td>16</td>
<td>72</td>
<td>not disclosed</td>
</tr>
<tr>
<td>Authorized use locations</td>
<td>53 labs, no clinic</td>
<td>130</td>
<td>6 buildings, 1 clinic</td>
<td>103</td>
<td>not disclosed</td>
</tr>
<tr>
<td>RADIOACTIVE MATERIALS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Authorized users (PIs included)</td>
<td>36</td>
<td>68</td>
<td>179</td>
<td>174</td>
<td>1300</td>
</tr>
<tr>
<td>Authorized use locations</td>
<td>74 labs</td>
<td>215 labs</td>
<td>500 labs</td>
<td>140 labs</td>
<td></td>
</tr>
<tr>
<td>X-RAY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X-ray equipment (all categories)</td>
<td>35</td>
<td>56</td>
<td>95</td>
<td>109</td>
<td>40</td>
</tr>
<tr>
<td>Laser/FTE</td>
<td>40.3</td>
<td>88.9</td>
<td>9.8</td>
<td>68</td>
<td>9.1</td>
</tr>
<tr>
<td>X-ray/FTE</td>
<td>13</td>
<td>18.9</td>
<td>2.7</td>
<td>18</td>
<td>7.3</td>
</tr>
<tr>
<td>RAM Labs/FTE</td>
<td>24.7</td>
<td>n/a</td>
<td>35.8</td>
<td>125</td>
<td>25.5</td>
</tr>
</tbody>
</table>

*Texas A&M was filling a vacant Health Physicist position. See Posting in Appendix B

Please note: “Authorized use location” and “Authorized Users” data were not used in this analysis because each institution classifies it differently than the University of Houston. Also, care should also be taken in interpretations of the raw data summaries- Laser/FTE, RAM labs /FTE and X-rays/FTE. For example, one CT x-ray unit at UT HSC Houston- a medical school will require more time and operational/regulatory obligations than one diffraction x-ray unit at the University of Houston. A clinic cannot be compared to a laboratory because of complexity of activities. Similarly, a surgical laser unit used in clinical applications will demand more oversight than a research laser unit. However, this benchmarking study is undertaken with the understanding that the complexities of research in a medical school like UT-HSC Houston, at
long-standing tier one universities like UT-Austin and Texas A&M, should point us an emerging institution like the University of Houston towards the right direction.

If we discount the complexity of equipment and processes earlier noted, UH seems to be operating more efficiently than UT-HSC Houston and CSU Fort Collins in Lasers/FTE and X-ray/FTE. However, UT-Austin and Texas A&M’s operation appear to be more efficient than UH in the Lasers/FTE and X-ray/ FTE category. The category of RAM Labs/FTE appears even among all institutions with the exception of Texas A&M with 125 RAM labs/FTE and for UT-Austin where the number of RAM labs/FTE was not provided. It appears from the foregoing analysis that UH, when fully staffed (save for turnovers) should be able to handle the program similar to the other institutions benchmarked.

<table>
<thead>
<tr>
<th>Table IV: Training Data Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOTAL PERSONNEL</strong></td>
</tr>
<tr>
<td>UH</td>
</tr>
<tr>
<td>UT-AUSTIN</td>
</tr>
<tr>
<td>UTHSC-HOUSTON</td>
</tr>
<tr>
<td>TEXAS A&amp;M</td>
</tr>
<tr>
<td>CSU, Fort Collins</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4.5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5.5</td>
</tr>
<tr>
<td><strong>TRAINING DATA</strong></td>
</tr>
<tr>
<td>Instructor led</td>
</tr>
<tr>
<td>Instructor led</td>
</tr>
<tr>
<td>Instructor led</td>
</tr>
<tr>
<td>Instructor led</td>
</tr>
<tr>
<td>Instructor led</td>
</tr>
<tr>
<td>5.5-9 hours</td>
</tr>
<tr>
<td>yes, 5.5 hrs</td>
</tr>
<tr>
<td>yes, 2.0 hrs</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td><strong>Initial Safety Training</strong></td>
</tr>
<tr>
<td>Hours of training</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5.5-9 hours</td>
</tr>
<tr>
<td>RAM Course/ Hours</td>
</tr>
<tr>
<td>yes/ 5</td>
</tr>
<tr>
<td>yes</td>
</tr>
<tr>
<td>no</td>
</tr>
<tr>
<td>yes</td>
</tr>
<tr>
<td>yes</td>
</tr>
<tr>
<td>yes, 2.0 hrs</td>
</tr>
<tr>
<td>X-ray Course/ Hours</td>
</tr>
<tr>
<td>yes/ 4</td>
</tr>
<tr>
<td>yes</td>
</tr>
<tr>
<td>yes</td>
</tr>
<tr>
<td>yes</td>
</tr>
<tr>
<td>Laser Course /Hours</td>
</tr>
<tr>
<td>yes/ 4</td>
</tr>
<tr>
<td>yes/ online</td>
</tr>
<tr>
<td>yes</td>
</tr>
<tr>
<td>yes</td>
</tr>
<tr>
<td>Laser Course /Hours</td>
</tr>
<tr>
<td>66</td>
</tr>
<tr>
<td>165</td>
</tr>
<tr>
<td>200</td>
</tr>
<tr>
<td>300</td>
</tr>
<tr>
<td>800</td>
</tr>
<tr>
<td>Average # (RAM)</td>
</tr>
<tr>
<td>71</td>
</tr>
<tr>
<td>75</td>
</tr>
<tr>
<td>52</td>
</tr>
<tr>
<td>55</td>
</tr>
<tr>
<td>Average # (X-RAY)</td>
</tr>
<tr>
<td>45</td>
</tr>
<tr>
<td>200</td>
</tr>
<tr>
<td>17</td>
</tr>
<tr>
<td>205</td>
</tr>
<tr>
<td>Average # (Laser)</td>
</tr>
<tr>
<td><strong>Refresher</strong></td>
</tr>
<tr>
<td>Online</td>
</tr>
<tr>
<td>Instructor led</td>
</tr>
<tr>
<td>Not required</td>
</tr>
<tr>
<td>Online</td>
</tr>
<tr>
<td>as needed</td>
</tr>
<tr>
<td>Average # (RAM)</td>
</tr>
<tr>
<td>108</td>
</tr>
<tr>
<td>33</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>330</td>
</tr>
<tr>
<td>96</td>
</tr>
<tr>
<td>Average # (X-RAY)</td>
</tr>
<tr>
<td>103</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>55</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>Average # (Laser)</td>
</tr>
<tr>
<td>74</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>205</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>Total trained annually</td>
</tr>
<tr>
<td>467</td>
</tr>
<tr>
<td>473</td>
</tr>
<tr>
<td>269</td>
</tr>
<tr>
<td>1150</td>
</tr>
<tr>
<td>896</td>
</tr>
<tr>
<td>No trained per FTE</td>
</tr>
<tr>
<td>155.7</td>
</tr>
<tr>
<td>105.1</td>
</tr>
<tr>
<td>44.8</td>
</tr>
<tr>
<td>287.5</td>
</tr>
<tr>
<td>162.9</td>
</tr>
</tbody>
</table>
From table IV, the number of programmatic trainings offered, hours per session and number of trainees per FTE did not differ so much from what is obtainable at UH. The numbers actually show that UH has trained more people per FTE than UT-Austin and UT-HSC Houston, but about the same as CSU, Fort Collins. However, the annual number of persons trained per FTE at UH is less when compared to Texas A&M. Please note that the number of trainees per FTE include annual refresher trainings for all institutions benchmarked except at UT HSC Houston where annual refresher training is not a mandatory program requirement.

**Process Benchmarking**: How other institutions benchmarked handle processes such as training, inventories, reports and program records was also reviewed.

<table>
<thead>
<tr>
<th>RECORDS</th>
<th>UH</th>
<th>UT-AUSTIN</th>
<th>UTHSC-HOUSTON</th>
<th>TEXAS A&amp;M</th>
<th>CSU, Fort Collins</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI Information</td>
<td>MS Access/Word</td>
<td>HPA/MS Excel</td>
<td>EHSA/MS Excel</td>
<td>EHSA</td>
<td>EHSA</td>
</tr>
<tr>
<td>Equipment/Sources</td>
<td>MS Excel</td>
<td>HPA</td>
<td>EHSA</td>
<td>EHSA</td>
<td>EHSA</td>
</tr>
<tr>
<td>Inventories</td>
<td>PDF</td>
<td>HPA</td>
<td>EHSA / MS Word</td>
<td>EHSA</td>
<td>EHSA</td>
</tr>
<tr>
<td>Permits, Authorizations</td>
<td>MS Word/PDF</td>
<td>MS Word</td>
<td>MS Word/EHSA</td>
<td>PDF</td>
<td>Web Module</td>
</tr>
<tr>
<td>New use application</td>
<td>MS Access</td>
<td>TXClass/MS Excel</td>
<td>EHSA/HR Dept</td>
<td>EHSA</td>
<td>EHSA/Access</td>
</tr>
<tr>
<td>forms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training</td>
<td>MS Excel/email</td>
<td>TXClass</td>
<td>No registration required</td>
<td>EHSA</td>
<td>Web based</td>
</tr>
<tr>
<td>records/documentation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>registration/notification</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*TXClass is a UT-Austin Software*

*EHSA- Environmental Health & Safety Assistant Software*

A variety of commercial off-the-shelf and/or institution-specific designed software packages are used to accomplish processes such as training administration, inventory management and
reporting, permit administration. At most institutions reviewed, EH&S Assistant Software (On Site Systems) is commonly used for inventory management and reporting while either EH&S Assistant or another training management software is used for training administration. New use application forms, as well as amendment to existing permits are generally managed through web-routed fillable PDF forms, EH&S Assistant Software and/or other web-based client applications.

**Inventory management, Reporting, Permit and Training Administration:** As displayed in the Table V, peer institutions employ automation in routine processes such as inventory of radiation producing equipment and sources, permit administration and training administration. Mandatory annual refresher trainings are not at some institutions reviewed (UT-HSC Houston), but at Texas A&M, refresher training is required and administered annually to about the same number of persons per FTE as UH. While both trainings are offered online, the training administrative functions at Texas A&M is automated (using EH&S Assistant). UT-Austin uses TXCLASS, a proprietary software application institution wide for training administration. UH EHS currently has plans to transition to Blackboard/PeopleSoft platform which should assist with automation of training administration, when successfully implemented.

**Technical and administrative assistance:** Some of the institutions receive technical assistance on tasks such as survey meter calibration, survey and wipe tests, waste disposal from Health Physics Technicians. While UH does not have HP Technicians, assistance is received from Hazardous Waste Specialists within the EHS department on radioactive waste pick up and disposal.
Position Titles and Salary:

Position titles were similar to benchmarked institutions. Available salary for public universities in Texas were obtained through Texas Tribune publication last updated June 2010. Information obtained on salaries, though very limited is shown in table below.

<table>
<thead>
<tr>
<th>Title</th>
<th>UH</th>
<th>UT-AUSTIN</th>
<th>UTHSC-HOUSTON</th>
<th>TEXAS A&amp;M</th>
<th>CSU, Fort Collins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vice President/RSO</td>
<td>n/a</td>
<td>n/a</td>
<td>$206,830</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Assist. Director/RSO</td>
<td>n/a</td>
<td>$96,564</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>RSO/Manager</td>
<td>$73,000</td>
<td></td>
<td>$86,142</td>
<td>n/a</td>
<td>n/a</td>
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<td>Asst. RSO/Manager</td>
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<td>n/a</td>
<td>$68,296</td>
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<tr>
<td>Asst. RSO</td>
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<td></td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Professional (Specialists)</td>
<td>$47,250</td>
<td>$36,440</td>
<td>$47,177 - $52,240</td>
<td>$34,306 - $49,234</td>
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<tr>
<td>Technical</td>
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<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

*Source: Texas Tribune, June 2010

An attempt to obtain salary survey from the Health Physics society was made. Recent surveys have targeted Certified Health Physicists (CHPs) and will not be useful for this report. The last survey (Health Physics Society Publication, March 2008) was conducted in 2007 [http://www.physics.isu.edu/radinf/Files/2007_hps_salary_survey.pdf](http://www.physics.isu.edu/radinf/Files/2007_hps_salary_survey.pdf). The 2007 average salary for MS Health Physics holders within the U.S. was $97,941.00. According to the report, Health Physicists within the Southern US region averaged $88,638.00, with the average for which University RSO (Salary by Job responsibility) at $77,794.00. Using the inflation rate from March 2008 to March 2011 of 8.82 % ([www.inflationdata.com](http://www.inflationdata.com)), current Health Physicists salary, based on the 2007 figures from the Health Physics Society should be an estimated $84,655.43.

A recent labor market trend analysis for health physicists conducted by the Oak Ridge Institute for Science and Education (ORISE) reported 2009 entry level salaries of Health Physicists as follows: $51,600.00 for a BS level, $62,000.00 for a MS level and $69,300.00 for a PhD level.

From the analysis, the current salary for the Assistant RSO position at UH seems adequate and comparable to salaries of peer institutions and surveys. The salaries for Safety Specialist and RSO/Manager position at UH appears to be lower based on the 2009 figures provided by ORISE, survey from Texas Tribune and inflationary projections using 2007 HPS salary survey.

**Current Status of Program Compliance at University of Houston**

Below is a listing of some of the major broad license/ certificate of registration conditions that we have not complied with in a timely manner.

- Radiation use locations have not been audited at least once per calendar year
- Inspection of Radiation Producing Equipment and Safety Equipment like Laser eyewear have not been conducted at least annually
- Annual program reviews required for the broad license have not been conducted timely
- Radioactive Waste Disposal, both quarterly in-house and Off-site Disposal are not performed timely, consistent with program requirements
- Quarterly Radioactive Material Inventory have not been completed
- Radiation use facility’s annual security reviews have not been conducted since 2009
- Operational program manuals have not been reviewed and updated
- Program records have not been reviewed to ensure inspection readiness
- Laser Safety Program is not implemented adequately
- Audit of Waste Vendors has not been carried out
- Emergency/Accident Response Training Program has not been instituted

The issues leading to non-compliance are two-fold: inadequate radiation safety staffing (due to position turn-over) to accomplish program goals and to a lesser extent, the lack of cooperation from certain PIs especially in the area of refresher trainings, acquisition and use of laser radiation
producing devices. Program staffing has been strained since October 2009. With the exception of program manager, all other positions have turned over at least once since October 2009. Position turnover has impacted program compliance greatly; the learning curve following position turnovers also impact programmatic functions adversely. Programming staffing levels per month from October 2009 until May 2011 is shown below*:

<table>
<thead>
<tr>
<th>Month</th>
<th>Oct-09</th>
<th>Nov-09</th>
<th>Dec-09</th>
<th>Jan-10</th>
<th>Feb-10</th>
<th>Mar-10</th>
<th>Apr-10</th>
<th>May-10</th>
<th>Jun-10</th>
<th>Jul-10</th>
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<td>3</td>
<td>3</td>
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<td>3</td>
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<table>
<thead>
<tr>
<th>Month</th>
<th>Sep-10</th>
<th>Oct-10</th>
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<th>Dec-10</th>
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<th>Feb-11</th>
<th>Mar-11</th>
<th>Apr-11</th>
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<th>June-11</th>
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<tbody>
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<td>No of Staff</td>
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<td>2</td>
<td>2</td>
<td>3</td>
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<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

*Current program staffing level is three personnel.

Conclusion:

UH’s Radiation Safety program benchmarking report shows that the current program staffing model is unique when compared with other established programs at UT HSC- Houston, Texas A&M, UT-Austin, Texas and CSU Fort Collins. While the current workload at UH is not so different from benchmarked institutions, a compelling argument could be made for process automation by looking into the operational dynamics of peer institutions, which show that other institutions are able to accomplish the workload with process automation and assistance from technical and/or administrative personnel. The program at UH can benefit more through either process automation and/or staff additions and this will assist with addressing noncompliance status of the program. While the current staffing level could be considered as adequate, it was also noted that hiring and retaining competent personnel is critical to program success and
operational continuity. If the program is fully staffed at current levels for a considerable period of time, compliance with license and registration conditions will be attained. The reviews also show that position titles are similar to institutions benchmarked, however, salaries for certain positions—the Radiation Safety Specialist/Health Physicist and Radiation Safety Manager/RSO were not adequate.

With the University’s emergence as a tier one institution and the consequent growth, it is reasonable to expect increasing levels of radiation-related research activities from various university departments and research centers. Coupled with the proposed activities at Energy Research Park and the upcoming biomedical complex, growth of the program is anticipated. While process automation can ensure processes are streamlined and hence increase operational efficiency, UH should anticipate the need for personnel addition of in the near future.
Appendix A

Radiation Safety Benchmarking

Program Scope

Total Number of personnel serving the entire Radiation Safety Program

Breakdown-Managerial, professional, Technical, Administrative

# regulated lasers-Class 3b and 4
# Laser Authorized users (PI's and AUs)
# authorized Laser use locations
# FTE's (Full Time Equivalents) serving laser safety program

# RAM Authorized users (PI's and AUs) AU's
# authorized x-ray use locations
FTE's serving RAM program

# of x-ray Equipment (All categories)
# X-ray Authorized users (PI's and AUs)
# authorized x-ray use locations
FTE's serving X-ray program

Programmatic items:

How do you maintain PI Information electronically to be easily queried and updated?

Inventories of Equipment and Sources/ Record Keeping - What technology?- HP Assist?

Managing existing Applications, Permits and Authorizations - What software modules do you use to maintain and update such?

New use application forms- web based or fill-able pdf, etc

Radiation Safety Training- Delivery (Instructor led or Web based). How many hours of initial training do you provide?

Maintaining training Records and Documentation- How do you maintain such- Electronic or database (Blackboard, People soft, EHS assistant, any other?)

How do you manage training registration and notifications?

Average number of persons trained annually per safety area.

X-ray, Laser, RAM

Refresher Trainings? Online or web-based? How many trained per year?

Other useful comments that will assist us with this benchmarking?
Position Information

Quicklink: tamujobs.tamu.edu/applicants/Central?quickFind=197084

Position Title: Health Physicist II

N.O.V. Number: 110507

Job Type: Full-Time

Department: Environmental Health & Safety-02-150005

The Health Physicist II is responsible for implementing the radiation control program for accelerators. For regulatory compliance, the Senior Health Physicist must ensure that 25 Texas Administrative Code §289.202 & 229, Nuclear Regulatory Commission 10 CFR 20, and ANSI 43.1 are adhered to. Implements, reviews, and updates all facets of the accelerator radiation safety program, including but not limited to: Reviews experimental protocols. Evaluates radiation fields and shielding. Provides radiation safety training to Cyclotron personnel. Ensures that doses to facility personnel are ALARA. May need to drive University vehicles to evaluate various sites across campus and off campus. Performs other related duties as required.

Major/Essential Duties of Job

Occasional Duties

Other duties as assigned.

Required Education and Experience

Master's degree in Health Physics, Nuclear Engineering, Nuclear Science, Radiological Health, Radiological Protection, or Radiological Science. Five years experience in radiological safety. Eligible for Certification by the American Board of Health Physics upon hire. Must have completed certification within three years of hire. Texas Class C driver's license or ability to obtain within 30 days of employment. Working knowledge of Texas Department of State Health Services, Radiation Control Program rules. Working knowledge of portable radiation survey instrumentation. Requires ability to multi-task and work cooperatively with others.

Preferred Education and Experience

Two or more years in an accelerator facility. Cyclotron experience is preferred.

Special Instructions to Applicants

Incomplete applications will not be considered. A quiz will be given to interviewees. Successful candidates will be subject to educational verification, criminal background check, fingerprinting, etc.

Salary

Starting salaries for positions may be negotiable based on qualifications and experience

$70,000 - $80,000

Pay Basis: Annually

Position Type: Budgeted - benefits eligible

(For details click here)

Location: College Station

Security Sensitive?

Employment in all positions are security sensitive and will be contingent on the results of a criminal background check at the point of hire. Please click

Yes
Is this position restricted by the Patriot Act? Yes

(For details click here)

Is this position D.O.T. regulated? No

(For details click here)

EEO/AA Statement

Texas A&M University is an equal opportunity, affirmative action employer committed to diversity.
INTRODUCTION

The University of Houston researchers receive funding from various sponsors to conduct research involving biological hazards including pathogens and potential human, animal or plant pathogens, recombinant DNA, select agents and toxins, as well as, any material requiring a CDC import license. UH researchers conduct this research at various buildings on the main campus and at the College of Pharmacy, Texas Medical Center. Biological research laboratories are currently 46% of the research laboratories at the University of Houston. This is a dramatic increase from 24% represented in FY 09. A few major contributors to this growth are the addition of research centers, such as the Center for Nuclear Receptors and Cell Signaling, a change in research dynamics which resulted from the previous VP of Research’s “Cluster” initiative, and increased research complexity with the emergence of work with recombinant viral vectors. The Environmental Health and Safety (EHS) department expects this trend to continue with the addition of the new Biomedical Building, Fleming Building addition and completion of the remaining floors in the Science and Engineering Research Complex Building.

The University’s Biological Safety program is administered by the Biological Safety Manager/Biosafety Safety Officer (BSO), and Biological Safety Specialists (SS) within EHS. Program oversight is provided by the Institutional Biosafety Committee (IBC) which is a requirement of the National Institutes of Health (NIH) when an institution receives any funding.
from such. The IBC consists of UH faculty members from various biological and biomedical disciplines, UH General Council, UH Animal Care, non-institutional members and EHS. The IBC ensures that research conducted at UH is in compliance with NIH Guidelines for Research Involving Recombinant DNA, CDC Select Agents Rule, the Biosafety in Microbiological and Biomedical Laboratories, as well as institutional biosafety policies and procedures.

In an attempt to reposition the UH Biosafety Program to meet the challenges of a Tier One Research University, a benchmarking study of the biosafety protocol approval process was conducted this year. Institutions benchmarked include Texas A&M University, College Station (TAMU), University of Texas, Austin (UT), University of Houston Health Science Center, Houston (UTHSC-H) and Rice University, Houston. These academic institutions have established programs and processes that will aid UH Biosafety Program in achieving more efficiency with the anticipation of increased research demands.

**Survey Methodology:** A questionnaire was developed to gather pertinent information regarding the biosafety protocol approval process. The program managers and/or Biological Safety Officers of the benchmarked institutions were contacted by phone for interviews. EHS/ research compliance websites of these related institutions were also reviewed to obtain pertinent information about the various programs. The responsibility of approving biosafety protocols rests between the Biosafety Officer and IBC members, with input from the Principal Investigator. In order to assess UH Biosafety Program (UH), data on IBC meeting frequency, the number of biosafety protocols reviewed and approved per year, biosafety protocol approval process, as well as the number of full time employees (FTEs) serving the biosafety program were collected and reviewed. Also, the work flow and processes implemented within the institutions to facilitate the approval process were compared to what is currently accomplished at UH. Finally, new Biological Safety Program Benchmarking, 2011
protocols and renewal/amendments to existing protocol processes at other institutions were
reviewed. The results of the benchmarking study will be discussed in the following section.

**Program Model Benchmarking:**

Committee oversight is critical to the success of the Biosafety Program in areas of protocol
review and approval. Different institutions surveyed use different approaches to achieve this
objective, either through the Biosafety Committee or an Institutional Biosafety Committee
(IBC). Institutional Biosafety Committees are a requirement of the NIH if funding is received
from such. IBCs are required to review all recombinant DNA (rDNA) experiments, assign
proper classifications, containment and safety plans. Minutes taken at IBC meetings are required
to be descriptive and must include detailed information about the aforementioned criteria. Also,
upon request, these minutes must be made available to the public therefore, requiring certain
redactions not to disclose locations and persons listed on protocols. It is for this very reason,
Biosafety Committees are formed. The Biosafety Committee is formed to review protocols that
do not involve the use of rDNA technology. An advantage to forming such a committee is to
minimize the detail when recording minutes and not have the obligation to post or produce
minutes as public documents. Of the institutions benchmarked, UTHSC-H and Rice had both
types of committees. UT and TAMU had IBCs but, the BSO made decisions to either approve or
send to the IBC protocols of non-rDNA origin.

**UH has an IBC that reviews biosafety protocols involving both recombinant DNA and non-
recombinant DNA.**
**Protocol Routing Process:**

Figure 1 outlines the current routing process of a typical biosafety protocol. Protocols are submitted to Biosafety by the Principal Investigator (PI) for review by the BSO. The BSO assigns an SS to act as the PIs representative to the IBC. The SS reviews the protocol and meets with the BSO to consolidate concerns regarding the protocol. The SS meets with the PI to receive rDNA training, if necessary, and/or to address concerns with the protocol. Corrections are made to the protocol based on information obtained from the PI/SS meeting. The protocol is then sent to a Subcommittee of the IBC, who will review the protocol for any deficiencies in critical information. The comments/concerns from the Subcommittee are submitted to the BSO, who then distributes them to the assigned SS. The SS again contacts the PI to address the Subcommittee concerns and makes the necessary corrections to the protocol. Now the protocol is ready for full Committee review. After Committee deliberation on the protocol, one of four outcomes is expected: **Approval** as presented, **Conditionally Approved** pending corrections from PI, **Tabled** with submission to another Subcommittee for review after corrections are received from the PI, or **Disapproved** with the protocol being re-submitted to the full Committee after substantial corrections are received from the PI.

From the aforementioned process, it is apparent that timely review and response from the Subcommittee is highly critical to the turnaround of a biosafety protocol, assuming that the initiating PI provides timely responses to both Biosafety and that of the Subcommittee and full Committee.
All of the institutions benchmarked had similar processes. Two key components, which could be contributing factors that facilitate the approval process, were of particular note:

I. **e-protocol**: All of the institutions benchmarked had an electronic routing process with tracking capabilities. In this way, every reviewer including the BSO is able to track and facilitate the review process by notifying the next reviewer.

II. **Administrative support**: All institutions benchmarked, with the exception of UTHSC-H, had an IBC Coordinator to collate all critical information from the PI. When the protocol information was complete, it is then submitted to the BSO.
UH currently does not have an e-protocol system or an IBC Coordinator.

UH Biosafety Office is currently partnering with the Division of Research on an electronic protocol routing application. It is hoped that upon successful implementation, an efficient routing process among reviewers will be accomplished.

In addition to the new protocol submissions process, renewal and amendments to existing protocols were also reviewed. The benchmarking study showed that all institutions have given authorization to the BSO to evaluate these protocols and determine if they will be submitted to full Committee.

UH is moving in this direction and BSO reviews and approves amendments and renewals based on content and degree of changes.

**Meeting Frequency and FTEs dedicated to Protocol Review**

Full Committee review is accomplished at full Committee meetings and the frequency of meetings at peer institutions was reviewed. All institutions benchmarked meet monthly. This can be attributed to the fact that these institutions currently review considerably more protocols annually than UH (Figure II), and with the exception of Rice, have more FTEs. Figure III represents the annual number of biosafety protocols reviewed per FTE, which ranges from 16 to 48.
UH meets at least three times per year and has been able to review all submitted protocols. However, with the anticipated growth in biomedical and biological sciences, increased meeting frequency is inevitable.

**Figure II**

Average Number of Biosafety Protocols Reviewed each Year

<table>
<thead>
<tr>
<th></th>
<th>UH</th>
<th>UT</th>
<th>UTHSC-H</th>
<th>Rice</th>
<th>TAMU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>50</td>
<td>240</td>
<td>108</td>
<td>88</td>
<td>96</td>
</tr>
</tbody>
</table>

**Figure III**

Average Number of Biosafety Protocols Reviewed each Year/FTE...

<table>
<thead>
<tr>
<th></th>
<th>UH</th>
<th>UT</th>
<th>UTHSC-H</th>
<th>Rice</th>
<th>TAMU</th>
</tr>
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<tbody>
<tr>
<td>Number</td>
<td>17</td>
<td>48</td>
<td>27</td>
<td>30</td>
<td>16</td>
</tr>
</tbody>
</table>
CURRENT PROGRAM INITIATIVES

The program has grown in status from 2008 until today in terms of the number of protocols per biosafety level presented to and approved by the Committee. UH Biosafety looks to accomplish more in the area of safe work practices, audits, and injury/accident prevention through training.

While the cost of biological waste disposal has been under control, UH Biosafety has been working with the Division of Research to procure clean and dirty autoclaves for buildings with biological research to further minimize waste disposal costs. It is anticipated that with the increase in biological research, the waste should be controlled. In addition to autoclaves, UH Biosafety will also monitor disposal practices at research laboratories to ensure only biological wastes are disposed in designated receptacles. Training on waste disposal will be provided where necessary. These will be accomplished during routine audits and proactive approaches.

The collaboration with other institutional safety committees will be further strengthened through routine meetings and information sharing. UH Biosafety has become very active with the Institutional Review Board (Human Subjects) and the Institutional Animal Care and Use Committee and is an integral part of their approval processes.
CONCLUSION

The emergence of more laboratories, addition of new buildings, increased research funding, increased research complexity and the addition of new programs, make it imperative for UH Biosafety to evaluate its current processes a discover ways to accommodate the approaching growth. Results of benchmarking study proved to be a very informative and a valuable tool gained to be used for increased protocol review and approval efficiency. In summary, the following recommendations should be considered in order to increase the efficacy and efficiency of the Biosafety Program:

- Increased meeting frequency of the full Institutional Biosafety Committee
- Empowerment of Subcommittee to grant interim approval to lessen the degree of increased meeting frequency of the full Committee
- Increased Subcommittee participation
- Electronic routing and tracking of protocols
- Formalize Biosafety Officer’s approval authority with IBC for amendments, renewals and non-rDNA BSL-1 protocols
- Modifying internal protocol review process to eliminate duplication of efforts by the empowering the Safety Specialists to contribute more
- Partnering with the Purchasing Department to receive alerts of new biological agents procured by PIs
- Distributing information packets to PIs outlining services offered, compliance requirements and assistance regarding their research
- Imposing protocol submission deadlines
REFERENCES

CDC- Biosafety in Microbiological and Biomedical Laboratories, 5th Edition

NIH-Guidelines for Research Involving Recombinant DNA Molecules, 2011

University of Houston Biological Safety Manual
<table>
<thead>
<tr>
<th>TITLE/(AREA)</th>
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<th>EMAIL ADDRESS</th>
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<td>Director</td>
<td>Robert D. Schneller</td>
<td>713-743-5868</td>
<td><a href="mailto:rdschneller@uh.edu">rdschneller@uh.edu</a></td>
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<tr>
<td>Administrative Assistant</td>
<td>Cydney Rax</td>
<td>713-743-8027</td>
<td><a href="mailto:crax@uh.edu">crax@uh.edu</a></td>
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<tr>
<td>Biological Safety Manager</td>
<td>Lisa Benford</td>
<td>713-743-1200</td>
<td><a href="mailto:lbenford@uh.edu">lbenford@uh.edu</a></td>
</tr>
<tr>
<td>Chemical and Occupational Safety Manager</td>
<td>Emmett Sullivan</td>
<td>713-743-5869</td>
<td><a href="mailto:esullivan@uh.edu">esullivan@uh.edu</a></td>
</tr>
<tr>
<td>Radiation Safety Manager</td>
<td>Otu Inyang</td>
<td>713-743-5867</td>
<td><a href="mailto:oinyang@uh.edu">oinyang@uh.edu</a></td>
</tr>
<tr>
<td>Assistant Radiation Safety Officer</td>
<td>Sangho Nam</td>
<td>713-743-5870</td>
<td><a href="mailto:snam4@central.uh.edu">snam4@central.uh.edu</a></td>
</tr>
<tr>
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