Composites and Polymer Engineering (CAPE) Laboratory

Environmental, Health and Safety Procedures and Policies Manual

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South Dakota School of Mines & Technology

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1. Introduction

1.1. Statement

The CAPE laboratory provides equipment, materials, space and training which support the course work and research efforts of faculty, staff and students of the university, as well as private contractors and their employees. The laboratory facility is staffed with full-time and part-time employees and is open 8:00am – 5:00pm, Monday through Friday.

The laboratory and its resources are shared by a community of individuals who facilitate and carry out research and projects which advance knowledge, understanding and the state of the art in their respective fields. Along with the rights and privileges which you are granted as a member of this community, come the responsibilities of safety, respect and courtesy which are necessary to foster a positive learning environment. Through safe and respectful cooperation, all members of our community can learn and prosper from one another – interaction and exploration are always encouraged. However, negligence of safety procedures and disrespect for the rights of others lead to dangerous working conditions which may threaten the safety and integrity of our community, and thus cannot and will not be tolerated. The policies in this manual outline the behaviors and practices which members of our community expect of themselves and of one another in order to maintain our culture of safety, respect and cooperation.

While the rules and procedures identified in this manual are defined and enforced by the laboratory faculty and staff, feedback and suggestions are always welcome and encouraged. Only through understanding of the perspectives of all members of the community can we expand and improve what we have to offer.

Before using the laboratory, you must read and understand this manual, and be prepared to conduct yourself according to these expectations. This manual has been prepared to comply with SDSM&T policy, VII-A-06, Emergency, Environmental, Health Safety, and Risk Procedure and Plans. In addition, situations will surely arise which are not specifically addressed in this document. In such a case, you are trusted to use your best judgment to uphold the safety and integrity of yourself and your peers.

LOSS OF PRIVELEGES – Failure to follow lab safety policies will result in your loss of access to the CAPE facilities for a time period determined by the CAPE laboratory staff and director. Access can be denied indefinitely depending on the severity of infraction. *You have the right to submit a statement of fact concerning any infractions to the CAPE staff and director.*

1.2. Persons of Authority

The term “CAPE Laboratory Staff” is used frequently in this document to refer to the CAPE Director, Composite and Polymer Engineers, and Composite and Polymer Scientists. Additionally, trained student employees may be able to assist in many instances, but are not considered staff for the purpose of making official judgments regarding safety issues.

1.3. Code of Ethics

To achieve the goals outlined in section 1.1, the CAPE staff and all users are required to adhere to the Code of Ethics for Engineers and The Chemical Professional’s Code of Conduct. These are presented in the following subsections.

1.3.1. National Society of Professional Engineers' *Code of Ethics for Engineers*, http://www.nspe.org/resources/pdfs/Ethics/CodeofEthics/Code-2007-July.pdf

National Society of Professional Engineers®

Code of Ethics for Engineers

Preamble

Engineering is an important and learned profession. As members of this profession, engineers are expected to exhibit the highest standards of honesty and integrity. Engineering has a direct and vital impact on the quality of life for all people. Accordingly, the services provided by engineers require honesty, impartiality, fairness, and equity, and must be dedicated to the protection of the public health, safety, and welfare. Engineers must perform under a standard of professional behavior that requires adherence to the highest principles of ethical conduct.

I. Fundamental Canons

Engineers, in the fulfillment of their professional duties, shall:

1. Hold paramount the safety, health, and welfare of the public.
2. Perform services only in areas of their competence.
3. Issue public statements only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

II. Rules of Practice

1. Engineers shall hold paramount the safety, health, and welfare of the public.
   a. If engineers' judgment is overruled under circumstances that endanger life or property, they shall notify their employer or client and such other authority as may be appropriate.
   b. Engineers shall approve only those engineering documents that are in conformity with applicable standards.
   c. Engineers shall not reveal facts, data, or information without the prior consent of the client or employer except as authorized or required by law or this Code.
   d. Engineers shall not permit the use of their name or associate in business ventures with any person or firm that they believe is engaged in fraudulent or dishonest enterprise.
   e. Engineers shall not aid or abet the unlawful practice of engineering by a person or firm.
   f. Engineers having knowledge of any alleged violation of this Code shall report thereon to appropriate professional bodies and, when relevant, also to public authorities, and cooperate with the proper authorities in furnishing such information or assistance as may be required.
2. Engineers shall perform services only in the areas of their competence.
   a. Engineers shall undertake assignments only when qualified by education or experience in the specific technical fields involved.
   b. Engineers shall not affix their signatures to any plans or documents dealing with subject matter in which they lack competence, nor to any plan or document not prepared under their direction and control.
   c. Engineers may accept assignments and assume responsibility for coordination of an entire project and sign and seal the engineering documents for the entire project, provided that each technical segment is signed and sealed only by the qualified engineers who prepared the segment.
3. Engineers shall issue public statements only in an objective and truthful manner.
   a. Engineers shall be objective and truthful in professional reports, statements, or testimony. They shall include all relevant and pertinent information in such reports, statements, or testimony, which should bear the date indicating when it was current.
   b. Engineers may express publicly technical opinions that are founded upon knowledge of the facts and competence in the subject matter.
   c. Engineers shall issue no statements, criticisms, or arguments on technical matters that are inspired or paid for by interested parties, unless they have prefaced their comments by explicitly identifying the interested parties on whose behalf they are speaking, and by revealing the existence of any interest the engineers may have in the matters.
4. Engineers shall act for each employer or client as faithful agents or trustees.
   a. Engineers shall disclose all known or potential conflicts of interest that could influence or appear to influence their judgment or the quality of their services.
   b. Engineers shall not accept compensation, financial or otherwise, from more than one party for services on the same project, or for services pertaining to the same project, unless the circumstances are fully disclosed and agreed to by all interested parties.
   c. Engineers shall not solicit or accept financial or other valuable consideration, directly or indirectly, from outside agents in connection with the work for which they are responsible.
   d. Engineers in public service as members, advisors, or employees of a governmental or quasi-governmental body or department shall not participate in decisions with respect to services solicited or provided by them or their organizations in private or public engineering practice.
   e. Engineers shall not solicit or accept a contract from a governmental body on which a principal or officer of their organization serves as a member.
5. Engineers shall avoid deceptive acts.
   a. Engineers shall not falsify their qualifications or permit misrepresentation of their or their associates' qualifications. They shall not misrepresent or exaggerate their responsibility in or for the subject matter of prior assignments. Brochures or other presentations incident to the solicitation of employment shall not misrepresent pertinent facts concerning employers, employees, associates, joint venturers, or past accomplishments.
   b. Engineers shall not offer, give, solicit, or receive, either directly or indirectly, any contribution to influence the award of a contract by public authority, or which may be reasonably construed by the public as having the effect or intent of influencing the awarding of a contract. They shall not offer any gift or other valuable consideration in order to secure work. They shall not pay a commission, percentage, or brokerage fee in order to secure work, except to a bona fide employee or bona fide established commercial or marketing agencies retained by them.

III. Professional Obligations

1. Engineers shall be guided in all their relations by the highest standards of honesty and integrity.
   a. Engineers shall acknowledge their errors and shall not distort or alter the facts.
   b. Engineers shall advise their clients or employers when they believe a project will not be successful.
   c. Engineers shall not accept outside employment to the detriment of their regular work or interest. Before accepting any outside engineering employment, they will notify their employers.
   d. Engineers shall not attempt to attract an engineer from another employer by false or misleading pretenses.
   e. Engineers shall not promote their own interest at the expense of the dignity and integrity of the profession.
2. Engineers shall at all times strive to serve the public interest.
   a. Engineers are encouraged to participate in civic affairs; career guidance for youths; and work for the advancement of the safety, health, and well-being of their community.
   b. Engineers shall not complete, sign, or seal plans and/or specifications that are not in conformity with applicable engineering standards. If the client or employer insists on such unprofessional conduct, they shall notify the proper authorities and withdraw from further service on the project.
   c. Engineers are encouraged to extend public knowledge and appreciation of engineering and its achievements.
   d. Engineers are encouraged to adhere to the principles of sustainable development[1] in order to protect the environment for future generations.

3. Engineers shall avoid all conduct or practice that deceives the public.
   a. Engineers shall avoid the use of statements containing a material misrepresentation of fact or omitting a material fact.
   b. Consistent with the foregoing, engineers may advertise for recruitment of personnel.
   c. Consistent with the foregoing, engineers may prepare articles for the lay or technical press, but such articles shall not imply credit to the author for work performed by others.
4. Engineers shall not disclose, without consent, confidential information concerning the business affairs or technical processes of any present or former client or employer, or public body on which they serve.
   a. Engineers shall not, without the consent of all interested parties, promote or arrange for new employment or practice in connection with a specific project for which the engineer has gained particular and specialized knowledge.
   b. Engineers shall not, without the consent of all interested parties, participate in or represent an adversary interest in connection with a specific project or proceeding in which the engineer has gained particular specialized knowledge on behalf of a former client or employer.
5. Engineers shall not be influenced in their professional duties by conflicting interests.
   a. Engineers shall not accept financial or other considerations, including free engineering designs, from material or equipment suppliers for specifying their product.
   b. Engineers shall not accept commissions or allowances, directly or indirectly, from contractors or other parties dealing with clients or employers of the engineer in connection with work for which the engineer is responsible.
6. Engineers shall not attempt to obtain employment or advancement or professional engagements by untruthfully criticizing other engineers, or by other improper or questionable methods.
   a. Engineers shall not request, propose, or accept a commission on a contingent basis under circumstances in which their judgment may be compromised.
   b. Engineers in salaried positions shall accept part-time engineering work only to the extent consistent with policies of the employer and in accordance with ethical considerations.
   c. Engineers shall not, without consent, use equipment, supplies, laboratory, or office facilities of an employer to carry on outside private practice.
7. Engineers shall not attempt to injure, maliciously or falsely, directly or indirectly, the professional reputation, prospects, practice, or employment of other engineers. Engineers who believe others are guilty of unethical or illegal practice shall present such information to the proper authority for action.
   a. Engineers in private practice shall not review the work of another engineer for the same client, except with the knowledge of such engineer, or unless the connection of such engineer with the work has been terminated.
   b. Engineers in governmental, industrial, or educational employ are entitled to review and evaluate the work of other engineers when so required by their employment duties.
   c. Engineers in sales or industrial employ are entitled to make engineering comparisons of represented products with products of other suppliers.
8. Engineers shall accept personal responsibility for their professional activities, provided, however, that engineers may seek indemnification for services arising out of their practice for other than gross negligence, where the engineer's interests cannot otherwise be protected.
   a. Engineers shall conform with state registration laws in the practice of engineering.
   b. Engineers shall not use association with a nonengineer, a corporation, or partnership as a "cloak" for unethical acts.
9. Engineers shall give credit for engineering work to those to whom credit is due, and will recognize the proprietary interests of others.
   a. Engineers shall, whenever possible, name the person or persons who may be individually responsible for designs, inventions, writings, or other accomplishments.
   b. Engineers using designs supplied by a client recognize that the designs remain the property of the client and may not be duplicated by the engineer for others without express permission.
   c. Engineers, before undertaking work for others in connection with which the engineer may make improvements, plans, designs, inventions, or other records that may justify copyrights or patents, should enter into a positive agreement regarding ownership.
   d. Engineers' designs, data, records, and notes referring exclusively to an employer's work are the employer's property. The employer should indemnify the engineer for use of the information for any purpose other than the original purpose.
   e. Engineers shall continue their professional development throughout their careers and should keep current in their specialty fields by engaging in professional practice, participating in continuing education courses, reading in the technical literature, and attending professional meetings and seminars.

Footnote 1 "Sustainable development" is the challenge of meeting human needs for natural resources, industrial products, energy, food, transportation, shelter, and effective waste management while conserving and protecting environmental quality and the natural resource base essential for future development.

As Revised July 2007

"By order of the United States District Court for the District of Columbia, former Section 11(c) of the NSPE Code of Ethics prohibiting competitive bidding, and all policy statements, opinions, rulings or other guidelines interpreting its scope, have been rescinded as unlawfully interfering with the legal right of engineers, protected under the antitrust laws, to provide price information to prospective clients; accordingly, nothing contained in the NSPE Code of Ethics, policy statements, opinions, rulings or other guidelines prohibits the submission of price quotations or competitive bids for engineering services at any time or in any amount."

Statement by NSPE Executive Committee

In order to correct misunderstandings which have been indicated in some instances since the issuance of the Supreme Court decision and the entry of the Final Judgment, it is noted that in its decision of April 25, 1978, the Supreme Court of the United States declared: "The Sherman Act does not require competitive bidding."

It is further noted that as made clear in the Supreme Court decision:
1. Engineers and firms may individually refuse to bid for engineering services.
2. Clients are not required to seek bids for engineering services.
3. Federal, state, and local laws governing procedures to procure engineering services are not affected, and remain in full force and effect.
4. State societies and local chapters are free to actively and aggressively seek legislation for professional selection and negotiation procedures by public agencies.
5. State registration board rules of professional conduct, including rules prohibiting competitive bidding for engineering services, are not affected and remain in full force and effect. State registration boards with authority to adopt rules of professional conduct may adopt rules governing procedures to obtain engineering services.
6. As noted by the Supreme Court, "nothing in the judgment prevents NSPE and its members from attempting to influence governmental action . . ."

Note: In regard to the question of application of the Code to corporations vis-a-vis real persons, business form or type should not negate nor influence conformance of individuals to the Code. The Code deals with professional services, which services must be performed by real persons. Real persons in turn establish and implement policies within business structures. The Code is clearly written to apply to the Engineer, and it is incumbent on members of NSPE to endeavor to live up to its provisions. This applies to all pertinent sections of the Code.

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1.3.2. The American Chemical Society's – *The Chemical Professional's Code of Conduct,* http://portal.acs.org/portal/PublicWebSite/careers/ethics/CTP_004007

The Chemical Professional's Code of Conduct

The American Chemical Society expects its members to adhere to the highest ethical standards. Indeed, the Federal Charter of the Society (1937) explicitly lists among its objectives **"the improvement of the qualifications and usefulness of chemists through high standards of professional ethics, education and attainments..."** The chemical professional has obligations to the public, to colleagues, and to science.

"The Chemist's Creed," was approved by the ACS Council in 1965. The principles of The Chemist's Code of Conduct were prepared by the Council Committee on Professional Relations, approved by the Council (March 16, 1994), and replaced "The Chemist's Creed". They were adopted by the Board of Directors (June 3, 1994) for the guidance of Society members in various professional dealings, especially those involving conflicts of interest. The Chemist's Code of Conduct was updated and replaced by The Chemical Professional's Code of Conduct to better reflect the changing times and current trends of the Society. It was approved by Council on March 28, 2007 and adopted by the Board of Directors on June 2, 2007.

Chemical Professionals Acknowledge Their Responsibilities

To the Public

Chemical professionals have a responsibility to serve the public interest and safety and to further advance the knowledge of science. They should actively be concerned with the health and safety of co-workers, consumers and the community. Public comments on scientific matters should be made with care and accuracy, without unsubstantiated, exaggerated, or premature statements.

To the Science of Chemistry

Chemical professionals should seek to advance chemical science, understand the limitations of their knowledge, and respect the truth. They should ensure that their scientific contributions, and those of their collaborators, are thorough, accurate, and unbiased in design, implementation, and presentation.

To the Profession

Chemical professionals should strive to remain current with developments in their field, share ideas and information, keep accurate and complete laboratory records, maintain integrity in all conduct and publications, and give due credit to the contributions of others. Conflicts of interest and scientific misconduct, such as fabrication, falsification, and plagiarism, are incompatible with this Code.

To Their Employer

Chemical professionals should promote and protect the legitimate interests of their employers, perform work honestly and competently, fulfill obligations, and safeguard proprietary and

confidential business information.

To Their Employees

Chemical professionals, as employers, should treat subordinates with respect for their professionalism and concern for their well-being, without bias. Employers should provide them with a safe, congenial working environment, fair compensation, opportunities for advancement, and proper acknowledgment of their scientific contributions.

To Students

Chemical professionals should regard the tutelage of students as a trust conferred by society for the promotion of the students' learning and professional development. Each student should be treated fairly, respectfully, and without exploitation.

To Associates

Chemical professionals should treat associates with respect, regardless of the level of their formal education, encourage them, learn with them, share ideas honestly, and give credit for their contributions.

To Their Clients

Chemical professionals should serve clients faithfully and incorruptibly, respect confidentiality, advise honestly, and charge fairly.

To the Environment

Chemical professionals should strive to understand and anticipate the environmental consequences of their work. They have a responsibility to minimize pollution and to protect the environment.

For more information about the Department of Career Services, Please see our Contacts List.

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2. General Safety

2.1. **Personal Responsibility – Safety First.** ***You*** are ultimately responsible for all that you do! Follow all safety and operation guidelines for each machine, tool or instrument. Basic training is available and required for every piece of equipment available for your use. If you are unfamiliar with a machine, operation, or instrument do not operate it and ask a CAPE staff person for assistance. The primary responsibility of the CAPE laboratory is to assist you in your education and safe use of the lab facilities. You will be held responsible for damage caused by your negligence. You are trusted to maintain the highest principles of ethical conduct as you use the CAPE facilities. Disregard for the standards set forth in this directive will be dealt with accordingly.

2.2. **Working Alone –** At least two persons must be present in the CAPE laboratory when equipment or instrumentation is in operation. At no time are you allowed to work alone in the CAPE laboratory area (i.e., another adult must be in the same room with you).

2.3. **Clean-up Requirements –** You are responsible to clean up after working in the lab. This includes:

- All tools used will be cleaned and replaced in their proper location.
- Cleaning equipment and storing in the proper location.
- Cleaning up and removing any chips, shavings, spills, or debris after each use.
- Removing or storing your project components.
- General cleanup of work area (sweep the floor and dispose of trash in the proper receptacle).

If you are working on a project and need to leave for a short period of time (one hour or less), let a CAPE staff person know when you will be back to finish your work and clean up your work area. However, do not leave any chips, shavings or debris that has hazard potential.

If you fail to clean up after yourself each day, then CAPE employees will clean your area and you or your team will be billed for this work at a rate of $150/hr, with a ½ hour minimum.

2.4. **Safety Equipment and Exits –** Know the location of safety equipment and building exit routes. Fire extinguishers, eyewash stations, emergency showers, telephones, material safety data sheet (MSDS) access, building exits, etc. are only useful if you know where they are.

2.5. **Emergency Situations –** "**Think**" first in an emergency! **Second**; if there is no question about the seriousness of an emergency, call "9-911". **Third**; Notify a CAPE staff person or call "2251" (Physical Plant) from any campus phone (394-prefix). Your first responsibility is to get as much emergency assistance as possible to the situation, while providing emergency care to the best of your knowledge. Refer to SDSM&T Policy VII-A-10

2.6. **Fire Alarms –** If you discover an uncontrolled fire, proceed to the nearest fire alarm pull station and activate the fire alarm system. If the fire alarm sounds, immediately turn off all equipment you are operating and exit the building. Follow the nearest **EXIT** sign to exit the building quickly and safely.

2.7. **Fire Extinguishers –** There are fire extinguishers located strategically throughout CAPE. Familiarize yourself with their location each time you enter a specific area within CAPE. If you have a small controllable fire, retrieve and use an extinguisher and immediately report the incident to a CAPE staff person.

2.8. **First Aid –** Immediately report all accidents to a CAPE staff person. Minor first aid supplies are available for simple cuts or abrasions. Do the best you can until qualified help arrives.

2.9. **Material Spills –** If you spill non-hazardous liquids or materials on any surface, clean them up immediately. If the materials are hazardous in nature or you are not sure they are hazardous, immediately notify a CAPE staff person and the Campus Environmental Health and Safety Manager (394-6729) to determine the proper course of action to be taken. MSDS's are found online at the computer terminal in the break room, or directly above in binder(s). These documents will contain proper remediation instructions.

2.10. **Eye Protection –** Safety glasses with side shields or goggles must be worn at all times while working in the lab areas that require them. Approved eye protection will be labeled as meeting the ANSI Z87 safety standard. Ordinary prescription glasses do not qualify as approved eye protection, and must

be supplemented by goggles or safety glasses designed to fit over glasses. Face shields are not approved primary eye protection and should only be worn over approved safety glasses or goggles.

2.11. **Hearing Protection –** There is a limited number of hearing protection devices available in the CAPE lab. It is recommended you purchase your own set of earplugs or some type of hearing protection for loud noise situations.

2.12. **Skin Protection –** There are chemicals, fibers and hot surfaces throughout the CAPE laboratory which may pose a risk upon skin contact. For your comfort and safety, it is recommended that you purchase a lab coat to protect your arms and upper body. Long pants and closed-toe footwear are always required. When working in situations which pose significant skin contact risks (i.e., thermal or chemical burns) a lab coat, gloves and possibly other special protective apparel will be required.

2.13. **Respiratory Protection –** Certain chemicals and particles pose short- or long-term respiratory health risks. Dust masks or respirators are required where signage indicates, and while handling materials which emit dangerous vapors or particles. If you are handling such materials it is your responsibility to protect yourself and to warn others in the area of your activities.

2.14. **Specific Lab Policies –** Certain areas of the lab may require specific attention to particular safety issues. Read and understand any safety notices or signage in the area in which you are working. If you have any questions, do not hesitate to ask.

2.15. **Machine Guards –** Machine guards are to be used at all times. Removal of guards is strictly prohibited. Contact a CAPE staff person to identify an alternative method to complete the activity.

2.16. **Modification of Equipment –** If you wish to modify the operation of a piece of equipment in order to test an experimental processing technique, discuss your proposed modifications with the CAPE staff. Before any modifications are approved, extensive safety analysis, procedures and justification will be required.

2.17. **Damaged Equipment –** It is imperative that anyone finding or causing any type of damage to equipment notifies the CAPE staff. This item will be taken out of service until repaired or replaced. A conscientious effort on everyone's part to follow this policy will reduce potential safety hazards significantly and assist in a timely return to operational status.

2.18. **Project Storage –** Clutter is a serious contributor to unsafe conditions, and an impediment to learning and efficient project execution. Storage is only available for materials and projects that are in progress which are related to your coursework or research. You must obtain approval from the CAPE staff to store projects in the lab. Any projects or materials that are left out will be removed or discarded. If you want to keep it, please take care of it!

2.19. **Use of Materials –** If you didn't buy it or bring it, it isn't yours! If you need materials or supplies, talk to the staff before using any materials in the lab area. The CAPE laboratory has a limited supply of materials that are used on a regular basis. You may look around for something that will meet your needs, but please do not use or cut up something until you have obtained permission from the CAPE staff.

2.20. **Equipment/Tool Checkout –** All equipment and tools are to remain in their appropriate areas. If you need to remove equipment or a tool from the CAPE laboratory, it must be checked out with a CAPE staff person.

3. Safety Resources

3.1. **Policy Documentation** – The current draft of this document will be considered the standard of safety procedures at the CAPE laboratory. In addition to this document, policies maintained by the State of South Dakota, the University, and the Environmental Health & Safety (EHS) Office also apply to activities carried out at CAPE. EHS documents are available at the EHS Web Page: http://sdmines.sdsmt.edu/ehs.

3.2. **MSDS –** Material Data Safety Sheets (MSDS) are available to the campus online via the MSDSonline service at http://www.hpcnet.org/cgi-bin/global/adprotected/a_bus_card.cgi?SiteID=421222. In the CAPE lab, this can be accessed using the dedicated MSDS computer station in the conference/break

room at the front of the building. All materials in inventory at CAPE have entries in this database. Any new materials brought into the building must be brought to the attention of the CAPE staff, and must be accompanied by an MSDS. The staff will either confirm that the MSDS is already in the database, or have it added.

3.3. **Incident Reporting –** All accidents, incidents and unsafe conditions should be immediately brought to the attention of the CAPE staff, and properly reported. EHS maintains an online incident reporting application which is accessible through the EHS Web Page at: http://sdmines.sdsmt.edu/incident.

4. Safety Resources

4.1. **Awareness of Risks –** The best way to protect yourself and others from danger is to be aware of the risks. Attention to details in your own experiments and in the working conditions around you will inherently increase the safety and integrity of your work. You are the expert on your experiment, and no one else can be as effective as you in making it safe. Do not be afraid to politely question the safety of other people's work, and do not be offended if others do the same – we are all responsible for protecting ourselves and each other.

4.2. **Eye Protection –** All users of the laboratory are required to wear approved safety glasses (ANSI Z87 standard) when operating or observing any equipment or experiment. Standard prescription eyeglasses *do not* meet this requirement, and must be augmented with approved safety goggles. Use of contact lenses is prohibited as accidental exposure to high heat or some chemical vapors can melt the lenses to the wearer's eyes. During some activities (e.g., wire-wheel usage, grinding) a full-face shield must be worn *in addition to* safety glasses. In case of chemical contact with they eyes, an emergency eye-wash station is located in the chemical handling ("wet lab") room.

4.3. **Hearing Protection –** Some motors, pumps, saws, and other equipment can reach and maintain high-decibel noise levels. In addition, the venting of high-pressure gasses can produce extremely high noise levels. Over-ear hearing protectors and disposable ear-plugs are available; however, you are encouraged to obtain your own personal protection.

4.4. **Skin Protection –** There are chemicals, fibers and hot surfaces in the laboratory which may pose a risk upon skin contact. For your comfort and safety, it is recommended that you purchase a lab coat to protect your arms and upper body. Long pants and closed-toe footwear are always required. When working in situations which pose significant skin contact risks (e.g., thermal or chemical burns) a lab coat, gloves and possibly other special protective apparel will be required.

4.5. **Respiratory Protection –** Certain chemicals and particles pose short- or long-term respiratory health risks. Dust masks or respirators are required where signage indicates, and while handling materials which emit dangerous vapors or particles. If you are handling such materials it is your responsibility to protect yourself and to warn others in the area of your activities. Respirators may be available from the CAPE laboratory for temporary use, but it is strongly recommended that you purchase and fit-test your own respirator to insure that it fits your anatomical features correctly. If you can breathe while covering the inlets on the respirator, then it does not fit and will not protect you.

4.6. **Asphyxiation –** Some equipment and experiments require the use of inert gasses such as nitrogen, argon or carbon dioxide to prevent oxidation of materials. ***These gasses are colorless and odorless, and overexposure will KILL you.*** Any equipment or experiment making use of inert gasses must be properly ventilated and purged. Venting inert gasses into the workspace can be a life-threatening safety hazard. Use and handling of inert gasses must be directly supervised by CAPE staff.

4.7. **First Aid –** In the event of minor cuts or burns, first aid kits are available at several locations throughout the lab, marked with signs above the kit. It can be very difficult to apply first aid to ones own wounds – if you see someone struggling to do so, please be a good neighbor and assist them.

4.8. **Emergency Response –** In the event of an accident or injury, ***remain calm and think before acting.***

- **First –** Be sure that the cause of the accident has been removed so that others are not injured.

- **Second –** Immediately contact emergency services. If you are using a campus phone, dial "9-911." If you are using your cellular phone, dial 911. Be prepared to provide the location of the accident and a description of the injury. The address of the CAPE lab is 920 East Saint Patrick Street, and the closest major intersection is with Saint Joseph Street.
- **Third –** Inform CAPE staff of the accident and record important details promptly, before they are forgotten. Honesty and accuracy when reporting on an accident is vital to understanding what went wrong and avoiding it in the future.

4.9. **Safety Review –** Before conducting new or substantially changed experiments/projects, a Safety Review must be requested of a CAPE staff person and completed. A Safety Review will consist of the following (at a minimum):

1) Describe experiment goals and past behavior (if applicable)
2) Describe experiment procedure/parameters
3) Identify Environmental Health & Safety (EHS) concerns (to both personnel AND equipment)
4) Identify EHS steps to be taken

5. Fire Safety

5.1. **Flammable Material Handling –** Flammable materials are rated by the National Fire Protection Agency standard, and assigned a number, zero (0) through four (4.) Items with a flammability rating of two (2) or higher must be stored in a marked flammables cabinet. If you intend to bring flammable materials into the CAPE laboratory, you must get approval from a CAPE staff person and provide an MSDS before arrival.

5.2. **Fire Alarm** – Fire alarm pulls are placed in several locations throughout the CAPE laboratory, near each building exit.

5.2.1. Activating the alarm – If you encounter a fire which cannot be easily controlled with a fire extinguisher, proceed to the nearest fire alarm pull station and pull the lever all the way down to activate the alarm. Then proceed to the nearest exit.

5.2.2. Responding to the alarm – If you hear the fire alarm sound, stop your experiment and turn off any equipment which you are using, then proceed to the nearest exit and leave the building. Try to account for anyone who you know was in the building, but ***DO NOT re-enter the building for any reason.***

5.3. **Fire Extinguishers –** Fire extinguishers are placed in several locations throughout the CAPE laboratory, including near the exits and in several work rooms. If you encounter a small, controllable fire, retrieve a fire extinguisher and follow these steps:
- **Pull** the anti-discharge pin,
- **Aim** at the base of the fire,
- **Squeeze** lever and handle,
- **Sweep** from side to side.

5.4. **Fire Extinguisher Classifications –** There are various classes of fire extinguishers based on the type of fires they should be used on. The class of a particular fire extinguisher should be prominently displayed on its label. Every fire extinguisher will belong to one or more of these classes:
- **Class A:** For fires involving ordinary combustibles such as wood, cloth, paper, rubber and plastics.
- **Class B:** For fires involving flammable liquids such as gasoline, oil, solvents and oil-based paint.
- **Class C:** For fires involving energized electrical equipment such as wiring, fuse boxes, circuit breakers, machinery and appliances.

6. Chemical Safety

6.1. **Chemical Safety Policy –** The policies outlined in this document specify the chemical safety practices and procedures enforced in the CAPE Laboratory. In addition to these, chemical safety practices and procedures which apply to the entire University are outlined in the University's Chemical Hygiene Plan (CHP.) The CHP document is available online from the Environmental Health & Safety Department at: http://sdmines.sdsmt.edu/ehs. As a user of University facilities, you are expected to understand and comply with the CHP.

6.2. **Chemical Classification and Storage –** Chemicals stored in the CAPE Laboratory must be contained and segregated appropriately. Flammable or corrosive materials must be stored in special, conspicuously-marked cabinets throughout the lab. Acids and bases should not be stored together, and any chemicals known to react with water must be stored away from all other chemicals. Special storage areas may be specified and labeled by the CAPE Laboratory staff as needed. A walk-in freezer is available for chemicals or materials which require cold storage.

6.3. **Procurement, Access and Record Keeping** – If you wish to store a chemical in the CAPE Laboratory, discuss this with a staff person *before* making plans. If you are given approval to store your chemicals at CAPE, you will be required to provide an MSDS to CAPE staff, and to have your chemicals inventoried by the Chemistry Storeroom. You will also be responsible for meeting any special waste-handling or disposal requirements related to your chemicals. You may access your chemicals during business hours. CAPE staff will attempt to insure that others do not use your chemicals without permission, but you are responsible for keeping records of your own inventory.

6.4. **Drying and Desiccating –** Ovens may be carefully used for drying of materials which will not fit in or will saturate a desiccator cabinet. Be aware of the properties and reactivity of your material as it dries and after it is dried. Do not oven-dry materials at unnecessarily-high temperatures. ***Under no circumstances*** should an oven with an exposed heating element be used to evaporate flammable or corrosive solvents. Desiccator cabinets are available for maintaining small amounts of dried materials.

6.5. **Handling and Transferring –** When pouring, scooping, pumping or otherwise handling chemicals, wear proper personal protective gear. This may include lab coat, gloves, goggles, respirator, full-face shield, or other specialized equipment. Transfer chemicals from bulk storage to smaller, more manageable containers for handling. Do not return unused chemicals to bulk containers, but dispose of this waste properly.

6.6. **Combining and Mixing –** Do not combine or mix chemicals randomly, irresponsibly, or with no understanding of possible reactions. Many reactions result in sudden and dramatic changes in temperature, volume, volatility or toxicity – make the necessary arrangements to safely handle the raw materials as well as the products and by-products of your experiment.

6.7. **Ventilation and Fume Hoods –** Certain rooms in the CAPE Laboratory are equipped with ventilation systems for the removal of fumes, vapors or dust. These systems should be in use any time that fumes, vapors or dust will be generated by your activities. Fume hoods are available for accommodating experiments which require meticulous ventilation. When ventilation systems are in use, doors into the area should remain closed, except when entering or exiting.

6.8. **Clean-up and Waste Disposal –** Dirty lab-ware and tools are to be promptly and thoroughly cleaned and returned to their appropriate storage location after use. Damaged lab-ware and tools should be immediately reported to a staff person. Spills should be contained and reported to a staff person immediately. You are responsible for leaving your work area in the same condition that you found it. Waste products and used cleaning materials must be disposed of properly. Hazardous waste materials must be stored in properly marked containers, and disposed of in accordance with Environmental Health & Safety (EHS) policy – ask a staff person for assistance.

7. Electrical Safety

7.1. **Equipment Disconnects –** Large equipment which is directly wired to the lab's electrical system will have a fused disconnect switch located on or near the machine. The disconnect should be turned off when the machine is not in use, and can be used as an emergency shut-down switch. Equipment

which is not direct-wired (connects via a plug and outlet) may not have a disconnect switch at the machine, but can be unplugged when necessary.

7.2. **Electrical Connections** – The electrical system in the lab provides four different combinations of voltage and phase, as well as current limits on all circuits. To insure connection to the correct circuit, plugs and outlets are matched. *If a plug does not fit an outlet, then it is the wrong outlet – DO NOT attempt to force the plug into the outlet.* Plugging a device into the wrong outlet will damage the device and could injure the person attempting to use it.

7.3. **Power and Extension Cords –** Extension cords have a maximum capacity which is related to the size of the wires in the cord and the length of the cord. If you do not know the capacity of a cord or the capacity which you require, ask a CAPE staff person for assistance. All extension cords used in the CAPE laboratory must be grounded, with three-prong ends. Do not use three-to-two prong adapters, and do not use cords with the grounding prong removed. If you find a cord or extension with any kind of damage, do not use it, and report it to the CAPE staff so that it can be repaired or replaced.

8. Machine Safety

8.1. **Machine Operation –** One individual is responsible for the operation of a machine at any time. If operation of the machine requires assistance, the person who checked-out the machine is responsible for supplying their own assistant and is responsible for the safe and orderly operation of the experiment. Equipment is not to be left unattended unless it is designed to run unattended. If you must leave the area, you MUST inform a CAPE staff person before leaving. You are still responsible for your own experiment, so it is recommended that you be present at all times.

8.2. **Pinch-points and Rotating Equipment –** Many of the machines in the CAPE lab have moving or rotating parts which can catch or crush loose objects. Before operating a machine, understand how it works and know the dangers and risks inherent in its operation. Do not wear loose clothing or leave long hair down when operating equipment.

8.3. **Hydraulic and Pneumatic Systems –** Many of the machines in the CAPE lab use fluid pressure systems (hydraulic or pneumatic) for actuation of pistons and motors. Damage to these systems or the pressure-carrying hoses can result in release of hot, high-pressure fluid. This can be a serious burn, puncture and injury risk to those nearby. If you see or cause damage to any hydraulic or pneumatic hose, fitting, pump or actuator, DO NOT use the equipment and report the damage immediately to a CAPE staff person.

8.4. **High-temperature Safety –** Many of the machines in the CAPE lab use high-temperature vessels or surfaces to heat materials to working temperature. Be aware of hot surfaces, containers, and materials. Some materials (like most plastics) are processed at temperatures which can cause third-degree burns almost instantly and will stick to skin or clothing. Wear a lab-coat and appropriate gloves (e.g. high-temp, high-temp & solvent resistant, etc) when handling hot equipment or materials.

9. Tool Safety

9.1. **Manuals and Instruction –** The operation and maintenance manuals for power and hand tools at CAPE are stored in the conference room. You must review these manuals prior to working with CAPE equipment. If you cannot find a manual or require additional assistance, contact a CAPE staff person. If you do not know how to use a tool, request assistance or training from a CAPE staff person.

9.2. **Tool Selection** – Every tool is designed for a specific job – and only that job. If you are not sure what tool to use, ask other users or the CAPE staff for assistance. Using tools for purposes other than intended is dangerous to people and to the tool.

9.3. **Tool Care –** Tools wear and will occasionally need to be serviced or replaced. If a tool is damaged or not performing properly, cease using it and bring it to the attention of the CAPE staff. The tools

available in the CAPE lab are to be shared by all users, please treat them as well as you would if they were your own.

9.4. **Hand Tools –** Hand tools often have sharp points or edges which can be dangerous if not respected. Handle and transport them with sharp edges pointed in a safe direction. Dull tools require more force and work unpredictably, making them a significant danger – keep them sharp or have them sharpened by a CAPE staff person.

9.5. **Power Tools –** Power tools enhance productivity by working faster or applying greater forces to the work piece – this also means that the potential for injury is increased. Do not attempt to operate two-handed tools with one hand, and let tools come to a complete stop before putting them down or handing them to another person. Large power tools will require specific training from the CAPE staff. Instruction or operator's manuals for smaller power tools are available (see section 9.1. above).

10. Woodworking Safety

10.1. **Large Power Tools –** Several large power tools are available in the sanding and finishing shop for building molds and tools. These tools can be very dangerous if you do not understand how to use them. Training for these tools is available and required.

10.2. **Guards and Safety Devices** – Blade guards, guides and other safety devices are installed for a reason. They are not to be removed or modified by anyone other than CAPE laboratory staff. If safety devices are removed or disabled, do not use the equipment and inform the staff.

10.3. **Personal Protection –** Some tools in the sanding and finishing shop require personal protective gear beyond what is required in the rest of the lab. Face shields, dust masks, gloves, etc. may be required when working with specific tools. You will be trained on the specific requirements when you are trained on the tools.

10.4. **Environmental Dangers –** The dust and debris in the sanding and finishing shop may pose several health risks. Saw dust, especially from cutting fiber-reinforced composites, can cause severe lung damage if inhaled. In addition, skin contact can cause severe discomfort or rashes.

11. Materials Safety

11.1. **Material Storage –** Materials which are stored at CAPE must be stored in specific areas to keep them free of certain contaminants. If you have materials which are appropriate to store at CAPE, discuss them with a CAPE staff person to arrange for space.

11.2. **Tooling and Mold Storage** – Molds and tooling which are parts of an active project may be stored at CAPE. Old tooling which is no longer actively used must be removed from CAPE and stored elsewhere. Old tooling can be a valuable learning tool in the future, but CAPE does not have room to store antiquated pieces.

11.3. **Shelves and Heavy Lifting –** When moving near shelves, be aware of objects which protrude from the shelf and be careful to not lean on shelves and risk knocking them over. If you need to lift a large tool, mold or package of material, ask for assistance. Lift carefully with your legs to avoid injuring your back. If necessary, floor space can be found to store extremely heavy molds and tools.

12. Access & Equipment Usage Safety

12.1. **CAPE Lab General Safety Training –** Before using the CAPE laboratory, you are required to read and understand this document, view the American Chemical Society's "Starting with Safety" DVD, and return a signed Environmental, Health, and Safety Policy Agreement form (see Section 14.1.) Additionally, in-person or online training for all equipment and instrumentation is required of all users who wish to work in the CAPE laboratory.

12.2. **Equipment Training** – All equipment, instrumentation and sophisticated tools require specific training and authorization by a CAPE staff person. Records will be kept of who has completed training for each piece of equipment, instrument, and sophisticated tool. If you wish to use a piece of equipment, instrument or sophisticated tool, contact a CAPE staff person and arrange a time for a training session.

12.3. **CAPE Building Access –** Access to the CAPE laboratory can be arranged for students, staff, faculty and industrial clients actively working on projects. Consult with a CAPE staff person to discuss your access needs. To initiate the access process, please file out and submit a CAPE Access Request Form (see Section 14.2) to a CAPE staff person.

12.4. **Visitors –** Visitors are welcome at the CAPE laboratory. If you intend to bring a visitor into the lab, inform a CAPE staff person in advance. Visitors are required to adhere to all safety policies, and are the responsibility of their host. Visitors are not allowed to take part in experiments or equipment operation.

12.5. **Equipment, Instruments and Tools Training List –** All large processing equipment as well as several pieces of woodworking equipment and sophisticated control and measurement devices may only be used by individuals following training by a CAPE staff person. A list of available equipment and training requirements will be maintained by CAPE Laboratory staff, and will be available on the CAPE web site or by request. The contents of this list will change periodically as new equipment or equipment upgrades become available.

13. Revision History

13.1. **Original Publication – V1.0 –** January 2009

13.2. **First Minor Revision – V1.1 –** September 2009

13.2.1. Added clean-up fee to Section 2.3

13.2.2. Added revision history – Section 13, moved Forms to Section 14, updated references

13.3. **Second Minor Revision – V1.2** – June 2010

13.3.1. Corrected hours of operation in Section 1.1

14. Forms

14.1. **CAPE Safety Policy Agreement –** Before being permitted to take part in any activities or experiments in the CAPE Laboratory, users must review, agree to, sign and return the CAPE Safety Policy Agreement. (see following pages)

14.2. **Request for CAPE Lab Access** – The CAPE Access Request Form (see following pages) must be completed and submitted by anyone requesting card-reader access to the laboratory. This form will also be used by the CAPE Laboratory staff to record which processing equipment you have been trained on and are approved to use.

Laboratory Environmental, Health and Safety Agreement

Composites and Polymer Engineering (CAPE) Laboratory
South Dakota School of Mines and Technology

Directions: Read each statement below and sign at the bottom of the page. By signing this form, you acknowledge that you have read the *"CAPE Environmental, Health and Safety Procedures and Policies Manual,"* and agree to abide the procedures and policies set forth, and that you have viewed the required sections of the ACS *"Starting with Safety"* video. If you fail to follow the rules, you may be dismissed from the CAPE Laboratory.

1. Food, beverages, or any type of tobacco products are prohibited in the laboratory at any time.
2. All personal items, food and beverages must remain in the office area of the lab.
3. Hair extending below chin level is a hazard and must be tied back.
4. Hands should be washed before using the restrooms and before eating or smoking. Areas of exposed skin (e.g. forearms) should be washed frequently if there is potential of contact with chemicals.
5. Eye protection must be worn when in lab work areas, unless specified otherwise. Contact lenses are not permitted to be worn in the laboratory.
6. Proper clothing must be worn at all times in the laboratory. Shorts, sleeveless, mid-drift and/or revealing shirts, open-toed shoes, open-backed shoes, crocks, sandals, and shoes with holes are NOT allowed.
7. Become familiar with the location of safety equipment in the laboratory. This includes the fire extinguishers, eyewash station, safety shower, and spill absorbents. First Aid supplies are located throughout the lab with appropriate signage.
8. Horseplay and other acts of mischief are prohibited.
9. If you are pregnant, trying to become pregnant, have allergies or sensitivities, inform the lab staff immediately.
10. ANY spill, accident, or chemical exposure must be documented with lab staff – IMMEDIATELY!!!!
11. In case of a fire alarm: reduce all operations to a safe condition as quickly as possible: turn off gas supplies, hot plates, stir plates, and heating mantles, shut windows and doors and evacuate the lab.

NAME (print): _____ Date:_____

SIGNATURE: _____

Return signed form to a CAPE Laboratory staff member. Copies are available, upon request.

Composites and Polymer Engineering (CAPE)
Access Request Form

PERSONAL INFORMATION

Name:

Position *(faculty, staff, student, other – please identify)*:

SDSM&T ID Number:

Contact Information:

Email Address:
Telephone Number:

PROJECT INFORMATION

Project Title:

Project Support *(Private, Industrial, State, Federal; provided agency name e.g. SD Board of Regents or NASA)*:

Project Mentor/Manager/Advisor:

Equipment(s)/Instrument(s) to be Used (*anticipated*):

Requested Access:
Start Date: _____ End Date: _____

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Internal Use:

Environmental, Health and Safety Training: No Yes Date:_____ User Initials: _____

Equipment and/or Instrument Training

1. _____ No Yes Date:_____ User Initials:_____
2. _____ No Yes Date:_____ User Initials:_____
3. _____ No Yes Date:_____ User Initials:_____
4. _____ No Yes Date:_____ User Initials:_____
5. _____ No Yes Date:_____ User Initials:_____