U.S. DEPARTMENT OF ENERGY
SOLAR DECATHLON

The Solar Decathlon 2015
Environment, Health & Safety Plan (EHSP)

Team Stevens Institute of Technology (SIT)

SURE HOUSE
a new direction for coastal housing

DRAFT

This preliminary submission is sufficient for the October 9th deliverable. You do not need to resubmit it now, but do need to continue to update and submit a 95% complete document on February 12, 2015.

Team Review and Approval Signatures		
Team Project Manager **Name:** Ed May	**Team Health & Safety Officer** **Name:** Allison Outwater	**University EH&S Officer** **Name:** David Fernandez
Signature:	**Signature:**	**Signature:**
Date:	**Date:**	**Date:**

U.S. DEPARTMENT OF ENERGY
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SECTION 1 – TEAM KEY PERSONNEL IDENTIFICATION			
Team Key Personnel	**Name**	**Phone Number(s)**	**Email**
Team Project Manager	Ed May	510-499-5191	EMay@stevens.edu
Team Construction Manager	Tom King	315-416-3099	tking332@gmail.com
Team Health & Safety Officer	Allison Outwater	732-685-2091	AOutwate@stevens.edu
University EH&S Representative	David Fernandez	201-912-4651	David.Fernandez@stevens.edu
Team Faculty Advisor	John Nastasi	917-579-1814	JNastasi@stevens.edu
Subcontractors - Company Name	**Name of Designated Safety Representative ****	**Phone Number**	
Enter Subcontractor Company Name	Enter name of individual**	Enter number: xxx-xxx-xxxx	
Enter Subcontractor Company Name	Enter name of individual**	Enter number: xxx-xxx-xxxx	
Enter Subcontractor Company Name	Enter name of individual**	Enter number: xxx-xxx-xxxx	

SECTION 2 - STATEMENT OF POLICY

Team SIT will comply with the Code of Federal Regulations (CFR) Title 29, Part1910 General Industry Safety and Health Standards and Part 1926 Safety and Health Standards for Construction Industry, NFPA 70E Standard for Electrical Safety in the Workplace, DOE-STD-1090-2011, ANSI Z359.1 Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components, and ANSI Z359.3 Safety Requirements for Positioning and Travel Restraint Systems

Our Health and Safety Plan includes procedures that apply to all contractors and volunteers that will be working with the team on site.

Team SIT will implement a training program which will teach students various aspects such as, their rights and responsibilities regarding a safe and healthy work environment in accordance with the worksite OSHA poster.

SECTION 3 - EMERGENCY PROCEDURES

First, evaluate the emergency. Take in the whole picture. Then:

1) Secure the scene to prevent further injuries.
2) Call 911 (or equivalent) for an emergency response.
3) Provide first aid, if needed, and if trained. The Health and Safety Officer will have Emergency Medical Technician training and all team members will have basic first aid training and CPR certification.
4) Remain at the scene until a public safety officer takes charge and report what is known of the incident to the public safety officer.
5) Call or notify Solar Decathlon headquarters, organizers, or event staff.

Improper conduct, the use of alcohol, and the use of illegal substances will not be tolerated and will be considered a rules violation subject to Rule 2-7. Improper conduct may include, but is not limited to, improper language, unsportsmanlike conduct, unsafe behavior, distribution of inappropriate media, and cheating.

A list of local clinics and hospitals in the Irvine, California area can be found in **Appendix 1**. This information can also be obtained from the Solar Decathlon headquarters on the Event site.

An ambulance will be on the site of the competition during the assembly phase, the public exhibit and the disassembly phase 24 hours per day. During the public exhibit hours an emergency medical technician (EMT) will also be on site. A first aid box and medical instructions will be available on site for small injuries that do not require major medical assistance.

In the event of a medical emergency, an ambulance will be immediately called and anyone with training can take the proper actions to address the situation. Once the first responders have arrived, the first responders are to take over the handling of the situation.

In case of fire, 2 fire extinguishers capable of handling all classes of fires will be available on site. The extinguishers will be kept in specified locations, which all team members will be aware of, and will not be moved unless necessary. If the fire extinguishers are moved for any reason, the new location will be made known to all team members. There will be an off-site muster spot for everyone on site. All workers will be made aware of the location prior to beginning work on site.

In case of an earthquake, especially at the public exhibit, work will be stopped immediately. Everyone should then take cover under a table or in a secure doorway and to stay away from windows or glass objects. Work will not resume until the site has been inspected by ____ and deemed safe to work.

The Hierarchy:
Any bodily injury incident should be reported to Chris Steffens (Assistant Project Manager) and Allison Outwater (Health and Safety Officer) immediately. Any chemical spill or construction malfunction should be reported to Ed May (Project Manager) immediately.

SECTION 4 - GENERAL RULES AND REGULATIONS
Any deviations from the rules and regulations regarding safety will be analyzed by the team and all appropriate actions will be taken on a case by case basis.

No alcohol or drug use will be allowed during the competition. In the event of any drugs (besides necessary prescriptions) or alcohol on the premises the individual with the offending material will be asked to leave the premises and not return for the remainder of the competition.

- Student(s) responsible for all health and safety activities while working at the competition site:
  - Allison Outwater (Health and Safety Officer)
- Chain of command listed from bottom to top for health and safety matters
  - Workgroup team members
  - Supervisor (Workgroup leader)
  - Health and Safety Officer
  - Construction Manager
- Stop work authority
  - Anyone on the team has the power to stop work at the site if they deem something unsafe or if necessary.
- Point of contact for health and safety information

- Allison Outwater can be reached for emergencies at 732-685-2091
- If Allison is off duty, Officer on duty (his/her phone number will be posted on site in a visible spot)

All team members should correct any potentially unsafe conditions if it is possible and safe to do so. If the team member is unable to do so, they should contact their supervisor who will stop the work and begin the chain of command process.

All team members will fill out daily reports about any situations that they deem in need of attention from a health and safety perspective. The reports will be reviewed daily by the Health and Safety Officer and appropriate action will be taken for each report.

SECTION 5 - HOUSEKEEPING

Each person on the construction site will be given a map which identifies the location of each material needed and all equipment on the site. For the duration of construction all team members will keep their work areas clean from all scraps and debris. The main areas of concern are the passageways, stairs and roof area which will all be given particularly close attention.

Different containers will be available for the collection of different types of waste. Containers will be provided for recyclables (wood, plastic, metals, etc.), trash and hazardous waste which will be equipped with covers.

Tools and excess materials will be stored in a locked container on site whenever not in use during assembly and disassembly. During construction at the school site all tools and building materials will be locked in the Griffith building at the end of the work day. Locked containers will also be utilized on the school construction site for any excess tools and materials. Temporary cords will be taped down and run along the side of buildings and walls as much as possible. Separate areas will be cordoned off for electrical materials, cords, painting materials, debris and construction materials.

Daily site inspections will be performed by the Health and Safety Officer at both the school site and the competition site.

SECTION 6 - ACCESS CONTROL

Organizer's caution tape will be kept as our primary barricade at the competition site. "NO ENTRY without APPROPRIATE EQUIPMENT" signs are placed around the construction site. Caution and Danger signs will be placed in areas most exposed to hazards. All signs, signals and barricades will comply with OSHA section #1926.200

All individuals entering the site must check in and be briefed before being allowed onto the site. Anyone performing construction must have the proper training for each tool being used and have complete approval to check out the tools and work with them.

Anyone who is not wearing the appropriate level of PPE will be asked to leave the site until appropriate PPE is acquired.

All media or visitors interested in accessing the site during construction of any phase must comply with the following:

- The visitors shall wear the minimum level of PPE before being briefed on the current activities;
  Or
- Stop work and secure hazards prior to allowing the visitors on site with the appropriate level of PPE.
- No access on site allowed if a person does not have the minimum level of PPE.

During assembly and disassembly and construction at the school, all personnel (workers, visitors, media, etc.) are required to wear the minimum level of PPE at all times in any construction area. The minimum level of PPE it a hard hat (ANSI Z89.1 or equivalent, Type 1, Class G or better), safety glasses with side shields (ANSI Z87.1 or equivalent), shirt with sleeves at least 3 in. (7.6 cm) long, long pants (the bottoms of the legs of the pants shall, at a minimum, touch the top of the boots when standing), and safety boots (ANSI Z41 PT99 or equivalent) with ankle support. Additional PPE or safety equipment shall be used if required for the task being performed.

The Health and Safety Officer is responsible for approving all PPE and granting access to the site. All individuals must check in and out with the Health and Safety Officer or another team member assigned that duty.

The following PPE shall be provided by the individual: boots, long pants, shirts with at least a 3” sleeve and hair ties to pull hair out of the face.

The following PPE shall be provided by the school: OSHA certified hard hat, approved work gloves, safety eyewear, rainwear, any additional PPE required for using certain tools.

The boundary of the site shall be [X] feet in diameter around the construction site. No one is to enter within that boundary unless checked in and approved for PPE wear.

Anyone on the team has the power to stop work at the site if they deem something unsafe or if necessary.

Restricting access-Determination of who is to restrict access with come in future reports.

SECTION 7 - ACCIDENTS AND INCIDENTS

In case an accident occurs on site, the first person notified is the Health and Safety officer. She will notify the Solar Decathlon safety officer and the team's construction manager. The team's project manager will then be notified.

The contact information for the Health and Safety officer is: Allison Outwater, 732-685-2091
The contact information for the Solar Decathlon Safety officer is
The contact information for the team's Construction Manager is: Clarke Snell, 828-230-9857
The contact information for the team's Project Manager is: Ed May, 510-499-5191

In case of such an event, the Health and Safety officer will complete a Solar Decathlon 2015 Incident Report Form. The Health and Safety Officer will have copies of the incident reports and will take proper action to address the situation.

To avoid any recurrence of an accident, the Health and Safety officer will look into the causes of the accident and write a report detailing what happened. This will include recommendations on how to prevent another accident of its type from occurring and will then be handed to the construction manager and project manager. The construction manager will then take actions based upon that report as soon as possible. He may stop work on the site until corrections have been made if he feels is necessary. All findings will be communicated with the entire team.

SECTION 8 - HEARING CONSERVATION

Due to potential high levels of noise on the construction site, it is recommended to everybody to wear ear plugs at all times. Any equipment that has the potential of generating noise levels of 85 dBA or greater will be labeled with a warning. PPE and ear plugs shall be worn while working with any equipment with the potential of generating those noise levels. Tools that can potentially generate noise levels of this level are hammers, cranes, saws, drills, etc.

The hearing protection will comply with 29 CFR 1910.95 Occupational Noise Exposure.

SECTION 9 - CHEMICAL & ENVIRONMENTAL SAFETY

Our team will comply with 29 CFR 1910.1200 Hazard Communication and will address the general requirements as follows:

- The storage space will have a designated area for all chemical hazard materials; this area will be covered, permanent naturally ventilated (cross ventilation), and also kept out of the sun and heat
- Next to and in the storage area there will be chemical hazard warning posters and that appropriate PPE needed for using chemical materials

- The storage space will be a sufficient distance away from the construction site so that it will not interfere with the work on site
- All chemicals will grouped per type and stored separately in different containers and clearly labeled in accordance with 29 CFR 1910.1200
- MSDS (materials safety data sheets) from the manufacturer of each chemical material will be bind and put in a visible and easy accessible place
- Each newly opened can shall be marked as such
- All fuels for the generator shall be stored in NFPA-compliant metal flammable cans with sealing spring-loaded lids. Fuels storage shall meet the storage requirements listed above. The generator shall be in secondary containment
- A poster with the hazardous materials and the appropriate spill cleanup materials shall be post in the storage area close to the hazard containers. The cleanup materials will be stored next to the poster unless the location is mentioned on the poster
- Minimum of PPE and appropriate tools are mandatory while working with any hazardous material. Face-masks with respirators shall be worn when working with hazardous chemical materials, per manufacturer's requirements.
- Our team will notify the Solar Decathlon organizers of any spills that occur on the National Mall whether they are hazardous or not.

SECTION 10 – FIRE PROTECTION & HOT WORK ACTIVITIES

There are currently no plans to be performing any spark or flame producing activities. However, should this change, this section will be updated accordingly.

Fire extinguishers will be placed by the ends of the kitchen closest to the front and rear doors of the home to allow easy access and to back out of the home while extinguishing the fire. During construction at Stevens two fire extinguishers will be available in the Griffith building at all times and outside on the interior door of the tool storage shed which will be open and allow visibility during all construction. At the competition during construction fire extinguishers will be placed in storage containers and will be readily available if needed.

Distance from flammable/combustible materials will be determined for future reports upon development of the house.

Fire blankets, welding screens and fire watch materials will be provided on site and easily accessible near any flammable work. In the kitchen fire blankets and fire watch materials will be available during the competition.

SECTION 11 - HAND AND POWER TOOL SAFETY

The assembly of the house at the competition site will be done with a minimal use of power tools; however, some hand and power tools will be necessary to use. Construction on the school site will utilize power and hand tools for most construction of the home.

Impact tools, such as drift pins, wedges, and chisels, will be kept free of mushroomed heads.

The operators of each tool will be properly trained in how to use and emergency precautions of the tool.

All tools will be either new or in "like new" condition. Guards will be in place on all tools and will be checked regularly to ensure proper connections and operation. Cords will be checked on a regular basis to ensure the quality of their condition.

All power tools will be equipped with momentary contact "on-off" controls or lock-on control which can be turned off by a single motion of the same finger or fingers that turn it on. These tools will be grounded or will be the approved double insulated type.

Basic PPE (hard hats, gloves, long pants and sleeves appropriate footwear and safety glasses), will be worn at all times. For power tool use the appropriate PPE required is work gloves and hearing protection.

All tools will be inspected daily for defective equipment or cords and any defective tools will be tagged out of service.

SECTION 12 - ELECTRICAL SAFETY, SYSTEM, AND EQUIPMENT

Several steps will be taken to ensure team safety from electrical hazards. Some general requirements include:

- All electrical systems will be designed to NFPA 70 National Electrical Code, 2014 version as per Section 2 of the "Adopted Rules" of the 2015 Solar Decathlon Building Code V1.
- All components will be listed by an approved testing laboratory, or shall have been reviewed and have secured approval from Solar Decathlon Building Officials prior to placement of the component in Irvine, California. All electrical work will comply with NFPA 70E Electrical Safety, and shall be performed only by qualified individuals.
    - Only team members and team crew clearly identified as qualified electrical workers shall be permitted to work on electrical circuits and systems. Team members identified as "qualified" shall have received the electrical training
    - No energized work shall be allowed on any electrical system other than troubleshooting and zero-energy verification.
    - Electrical systems shall be locked out and tagged out (LOTO) prior to working on that system. Color coded locks will be provided to all team members working on electrical systems. Locks will also be provided for crew members provided they do not have their own. All individuals working on an electrical system will place his/her personal lock on the

system. They will remove their lock only when they complete their work on the system.
    - Qualified team members will perform zero-energy verification before working on an electrical system after LOTO has been applied.
    - All work, based on the size of the system, working distance, grounding, etc., will comply with 2015 version of NFPA 70E.
- All cord and plug tools used during assembly and disassembly shall be GFCI protected. Any generator used on site will be GFCI protected or GFCI pigtails will be provided.
- All electrical appliances and power tools will be rated for the necessary operating conditions.
- All cords shall be visually inspected by team members prior to their use. Should a cord be deemed unsafe it shall be promptly removed from service.
- The team members will participate in non-live construction only. All the electrical work will be supervised by a qualified person.
- The AC generator (Honda EU6500iS) planned for assembly does not have GFCI outlets. To mitigate this we plan to connect power cords via GFCI pig tails.

During fabrication, assembly, and disassembly of our house, personnel will be working on and around energized and de-energized DC and AC electrical components.

Applicable references for arc flash safety for the Solar Decathlon include, but are not limited to:

- IEEE 1584 (Section 9.3.2)
- NFPA 70E (Article 130)
- NFPA 70 (Article 110.16)
- OSHA 29 CFR 1910 S

LOTO Procedure

- Identify the energy source for the circuit or equipment that the team member want to work on/with
- Check if anyone is working on that circuit
- Isolate the energy source at all points related with the circuit work will be performed.
- All people working on the circuit will be informed that it will be shut
- Lock with the individual/color coded lock and tag the energy source(s)
- Check that the equipment isolation is de-energized
- Deplete stored energy by bleeding, blocking, grounding, etc. Team member performing the electrical service on electrical components of these types shall adhere to the discharge recommendations provided by the electrical manufacturer and advice of qualified supervising professional.

PPE

The appropriate PPE for all the zero-energy electrical work falls under Hazard Category 0. The appropriate PPE is safety glasses, face shields, hard hats, safety shoes, insulating (rubber) gloves with leather protectors, insulating sleeves, and flame-resistant (FR) clothing. After the appropriate LOTO procedure, the Hazard Risk Categories are:

Task	Hazard Risk Category	
	Non-Electrified	Electrified
Utility Panel and Utility Meter Electrical Work	**0**	**1**
Main Load Panel Electrical Work	**0**	**1**
Photovoltaic System Electrical Work	**0**	**1**
Plug Load Electrical Work	**0**	**1**
	AC Condition	**DC Condition**
Installation and Energizing of Electrical Components	**1**	**1**
Troubleshooting and Maintenance of Energized Electrical Components	**1**	**1**
De-installation and De-energizing of Electrical Components	**1**	**1**

Personal Protective Equipment (PPE) For Operating Electrical Equipment

This section includes Personal Protective Equipment (PPE) requirements for operating circuit breakers and disconnects switches (not wall light switches) that are rated 50 volts to 600 volts. All qualified electrical workers will only be exposed to voltages less than 600 volts. In all cases, the clothing and equipment required for the degree of exposure is permitted to be worn alone or integrated with flammable, non-melting apparel. If flame-resistant (FR) clothing is required, it must cover associated parts of the body, as well as all flammable apparel while allowing movement and visibility. PPE equipment will normally be used in conjunction with one another as a system to provide the appropriate level of protection. Clothing must cover potentially exposed areas as completely as possible. Shirt sleeves must be fastened at the wrists, and shirts and jackets must be closed at the neck.

Personal Protective Equipment (PPE) For Electrical Service Work

Equipment	Voltage	Amp	PPE Rating
Circuit Breaker Panels or Disconnect Switches operating at less than or equal to 240 V and rated less than or equal to 225 A	Less than or equal to 240 V	Less than or equal to 225 A	NFPA 70E Cat 0 and 1

The operating voltage and ampacity will determine the arc flash hazard, and the hazard level will determine the PPE level and flash protection boundary. When de-energizing equipment and performing ZEV, qualified electrical worker(s) in appropriate level of PPE will restrict access to all other individuals at the flash protection boundary with a safety barrier. The qualified electrical worker working within the area of possible arc-flash must wear appropriate PPE. The PPE needs to cover all exposed parts of the body but also to allow for movement and visibility. Also, non-conductive, no "meltable" fiber clothing (acetate, nylon, polyester, polypropylene, or spandex) underneath any required PPE clothing (exception is incidental amount of elastic on underwear or socks) is worn by our team members on site.

Protective Clothing Characteristics

NFPA Cat.	PPE Required
	An analysis of the available arc flash energy has been performed and PPE required is specific to this device, but in all circumstances we will require safety glasses with side shields. Since all voltages will be less than 600 volts no PPE above Category 1 will be required.
0 & 1	Is increasing the NFPA 70E Cat. 0 and 1 required PPE (i.e., non-melting, flammable natural materials such as untreated 100% cotton, wool, rayon, or silk, or blends of these materials with a fabric weight of at least 4.5 oz./yd2) long-sleeve shirt and long pants PLUS leather gloves (minimum leather palm with cotton back:), and safety glasses with side shields. (Cal/cm2 N/A)

Qualified Personnel to Engage in Electrical Work

List of persons to receive proper electrical training will be updated in future reports upon completion. Certificates of Certification will be available in Appendix 3.

SECTION 13 - MATERIAL HANDLING

- Gloves and appropriate PPE shall be worn during material handling activities. Heavy and or large items shall not be handled by one person. If the items are too heavy, a dolly will be used. Forklifts will be utilized for very large objects that

cannot be maneuvered by hand.

- All forklift / Telehandler operators shall be trained in accordance with CFR 1910.178 Power Industrial Trucks. A complete list of specific individuals who have completed training will be included in future H&S Plans.

SECTION 14 - HOISTING AND RIGGING

It is currently too early in the process for us to identify specific lifts / house maneuvers. As we refine the design we will submit a detailed H&S Plan for review

For general rules:

- All individuals involved directly with the maneuvering the house will be certified subcontractors; with the exception of a few team members placed strategically to assist with clearance and site security.
- All lifts will be pre-planned with our transportation sub-contractors. The house will be designed to withstand loads occurring with transportation and movement.

We will attach all diagrams for pick points and hoisting diagrams as they become available.

SECTION 15 - FALL PROTECTION/WORK FROM ELEVATED HEIGHTS

For general rules:

- Our team's Fall Protection Plan covers the circumstances of people working at above 18 inch off the ground as well as above 6 feet off the ground.
- When there is a break in elevation of 18 inches or more, a stairway or ladder shall be provided at all worker points of access. All workers must maintain heightened awareness when working near edges and openings. For the people working above 18 inch above the ground, there will be a secured ladder.
- A fall protection plan is designed for circumstances where people work above 9 feet distance from the ground or on the roof.
- Team members who are going to work above 6 feet off the ground shall go through a mandatory training session which covers:
    - Fall hazard recognition
    - Basic fall protection principles
    - Review of applicable, industry-related standards
    - Proper equipment cleaning & storage
    - Formal inspection procedure & documentation process

Ladder

- Portable ladders will be used for work up to 9 feet above grade
- All ladders shall comply with the loads specified in 29 CFR 1926.1053 Subpart X Ladders

- The ladder shall extend 3feet above the landing level or shall be anchored at its top to a rigid support
- Appropriate inspection shall be performed prior use.
- All workers shall be trained on proper use of ladders prior to start of construction process.

Scaffolding

- Our team will use tube and coupler type scaffolding on site; no modifications to the scaffolding will be made for interconnection or other constraints.
- On the site our team will be using supported scaffolding; the height of the scaffolding shall not exceed 4:1 ratio; the team assigned with the erecting of the scaffolding will receive appropriate training prior arriving on site.
- The scaffolding shall be fully planked securely tied to the frames.
- The scaffolds poles shall bear on base plate on mud (wood) sills.
- Guys, ties, and braces shall be installed at locations where horizontal members support both inner and outer legs.
- Along the edge of the platform shall be erected toe board and a guardrails system to protect from falling objects hazard.
- Daily checks of the scaffolding shall be performed to ensure basic integrity.

As specific scaffolding is determined, diagrams and other information will be provided in future reports.

SECTION 16 - OTHER SAFETY CONSIDERATIONS

- Adequate lighting at night on site shall be part of our initial site staging; stand-alone generator powered telescoping tower worksite lighting units will provide ambient light on the site. Headlamps will provide task lighting. All visitors shall be escorted through the site at any point in time.
- Each person may work maximum 12 hours per day. A work schedule will be developed for each team member to ensure no overworking of any individual.
- Any individual who will be entering the site at any time will be briefed on EH&S matters, PPE and tool safety as necessary.
- All change in management of any kind will be communicated to all team members through Basecamp and an announcement the morning of and as members arrive and check in. In the event of a change during the workday all construction will be stopped and the proper announcements and changes will be made

Santa Ana Winds

The team policy on winds will be updated in future reports.

Heat Stress

The team policy on heat stress can be found below. Further information regarding controls can be found in the AHA section.

Exposure to Heat Stress can result in several illnesses, as well as decreased productivity and increased likelihood of injuries. The Stevens Institute of Technology Sure House Heat Stress Management Program is designed to protect students against the risk of heat induced injuries and illnesses.

Heat stress occurs from internal heat production in the body from doing excess work or work in hot conditions. Other causes are from heat exposure in the environment. Both aspects need to be properly addressed to control heat stress.

Heat Stress is influenced by several risk factors: climatic conditions, the work environment, demands of the work being performed, clothing and personal characteristics. Temperature on the asphalt during the competition can reach up to 120 degrees Fahrenheit.

Climatic conditions that can affect the risk of heat-related disorders are:

- Air temperature and humidity
- Air movement
- Temperature of the surrounding surfaces which affects radiant heat exchange

Demands of the work influence the stress on the temperature regulation system. Individual responses to a given work-load vary, but as an employee expends more energy, the body's internal metabolic heat production rises. This increases stress on the cardiovascular system to regulate body temperature. Work-related factors that influence heat stress include:

- Work rate
- Level of physical effort
- Duration of activity

Clothing characteristics that affect the body's ability to regulate internal temperatures are:

- Insulation
- Permeability
- Weight
- Fit
- Ventilation
- Additional equipment
- Personal protective equipment

Personal characteristics that contribute to a person's susceptibility of contracting a heat-related illness are:

- Age

- Weight
- Previous heat stress injury
- Underlying medical conditions
- Medication use
- Overall health and physical fitness

Working in an environment with heat stress not only increases the risk for specific heat related conditions such as heat exhaustion and heat stroke, but also increases the risk for workplace accidents.

Methods to Prevent Heat Stroke

- **Drink plenty of water**. Water is essential to all processes in the body working correctly. Water is vital for the body to perform most of its functions and heat can cause more rapid water loss in the body so drinking plenty of water prevents the loss of too much water.
- **Use the buddy system.** Ensure that co-workers watch one another for signs of heat stress. Reduce physical demands by reducing physical exertion such as excessive lifting, climbing, or digging with heavy objects. Spread the work over more individuals, use relief workers or assign extra workers. Provide external pacing to minimize overexertion
- **Provide recovery areas**, such as air-conditioned enclosures and rooms, and provide intermittent rest periods with water breaks. Establish provisions for a work/rest regimen so that exposure time to high temperatures and/or the work rate is decreased
- **Reschedule hot jobs for the cooler part of the day.** Routine maintenance and repair work in hot areas should be scheduled for the cooler seasons of the year. When possible, outdoor work areas should be provided with coverings, such as a tarp, to provide shade
- **Monitor workers who are at risk of heat stress**, such as those wearing semi-permeable or impermeable clothing when the temperature exceeds 70°F, while performing strenuous tasks. Personal monitoring can be done by checking the heart rate, recovery heart rate, oral temperature, or extent of body water loss.

Personal precautions that Team members will take:

- Toolbox talk with Team members in California to reinforce Heat Stress Risks
- Provide cool water throughout work shift
- Fluid intake: Drink 5 to 7 ounces of cool water for every 15 to 20 minutes,
- Dress to Increase Reflection and Convection: Wear light-colored, loose-fitting, breathable clothing
- Reduce Ultraviolet Radiation: Work in the shade, A portable tent will be erected to provide an area of refuge from the sun
- Stop the Heat Build-up: Take frequent short breaks in cool shade
- Reduce Metabolic Heat: Eat smaller meals before work activity
- Avoid Dehydrating Liquids: Don’t drink caffeine and alcohol or large amounts of sugary drinks

- Follow the work rest schedule below

ACGIH THRESHOLD LIMIT VALUES FOR HOT ENVIRONMENTS			
Work Load			
Work-Rest Regimen	Light	Moderate	Heavy
Continuous Work (75-100% work)	86ºF (31ºC)	80ºF (28ºC)	77ºF (25ºC)
75% Work (50-75% work) 25% Rest, each hour	87ºF (31ºC)	82ºF (30ºC)	78ºF (27.5ºC)
50% Work (25-50% work) 50% Rest, each hour	89ºF (32ºC)	85ºF (30ºC)	82ºF (29ºC)
25% Work (0-25% work) 75% Rest, each hour	90ºF (32.5ºC)	88ºF (31.5ºC)	86ºF (30.5ºC)

APPROXIMATE WORKLOAD LEVELS	
Light	Sitting at ease, writing/typing, sorting light materials, inspecting crops, driving mobile equipment on paved roads, piloting spray aircraft.
Moderate	Using a chain saw, off-road operation of mobile equipment, periodic handling of moderately heavy materials, weeding, hoeing, picking fruits or vegetables, air blast and boom spraying, knapsack spraying on level ground, pushing or pulling light-weight carts or wheelbarrows, washing vehicles, walking 2-3 mph.
Heavy	Transferring heavy materials, shoveling, digging, hand mowing, loading sacks, stacking hay, planting seedlings, hand-sawing wood, pushing or pulling loaded hand carts or wheelbarrows, moving irrigation pipe, laying cinder blocks, knapsack spraying on rough ground or an incline, walking 4 mph.
Very Heavy	Heavy shoveling or digging, ax work, climbing stairs, ramps, or ladders, lifting more than 44 pounds at 10 lifts per minute, walking faster that 4 mph, jogging, running.

Heat Stress Injuries/Illnesses (symptoms, treatment, cause, prevention)

Heat Stroke
Symptoms: Usually hot, dry skin; red, mottled or bluish. Sweating may still be present. Confusion, loss of consciousness, convulsions. Rapid pulse. Rectal temperature greater than 104ºF. When in doubt, treat as heat stroke. Can be fatal.
Treatment: Medical emergency. Call paramedics and start cooling the victim immediately. Remove the victim to a cool area. Soak clothing and skin with cool water and use a fan to create air movement. Shock may occur. Medical treatment is imperative.
Cause: Partial or complete failure of sweating mechanism. The body cannot get rid of excess heat.
Prevention: Acclimatization, close monitoring for signs of heat illness, medical screening and drinking plenty of water.
Heat Exhaustion
Symptoms: Fatigue, weakness, dizziness, faintness. Nausea, headache. Moist, clammy skin; pale or flushed. Rapid pulse. Normal or slightly elevated temperature.
Treatment: Have the victim rest in a cool area and drink fluids.
Cause: Dehydration causes blood volume to decrease.
Prevention: Acclimatization and drinking plenty of water.
Heat Cramps
Symptoms: Painful muscle spasms in the arms, legs or abdomen during or after hard physical work.
Treatment: Resting, drinking water and eating more salty foods.
Cause: Not well understood. May be due to a loss of salt from sweating. Dehydration is a factor.
Prevention: Adequate water intake and adequate salt intake at meals; do not use salt tablets.
Heat Syncope

Symptoms: Fainting while standing erect and immobile. A variant of heat exhaustion. Symptoms of heat exhaustion may precede fainting.
Treatment: Move the victim to a cool area, have the victim rest and drink fluids.
Cause: Dehydration causes blood volume to decrease. Blood pools in dilated blood vessels of the skin and lower body, making less blood available to the brain.
Prevention: Acclimatization, drinking plenty of water, avoiding standing in one place and intermittent activity to avoid blood pooling.
Heat Rash
Symptoms: "Prickly heat"; tiny, raised, blister-like rash.
Treatment: Keeping skin clean and dry.
Cause: Skin is constantly wet from sweat. Sweat gland ducts become clogged, leading to inflammation.
Prevention: Showering after working in hot environment. Keeping skin dry.
Transient Heat Fatigue
Symptoms: Decline in performance, particularly in skilled physical work, mental tasks and those requiring concentration.
Treatment: No treatment necessary unless other signs of heat illness are present.
Cause: Discomfort. Stress from the heat less than what would result in other heat illnesses.
Prevention: Acclimatization and training.

SECTION 17 - TRAINING & DOCUMENTATION

- 30-hr construction safety training is required for the project manager, construction manager, and safety officer. See **Appendix 3 (to come with future H&S Plans)** for copies of the training certificates for individuals holding those positions (when completed). This training will be coordinated by Dave Fernandez, Director of Environmental Health and Safety, Stevens Institute of Technology.

- Additional 30-hr construction safety training will be completed by select members of the team. See Appendix 3 (to come with future H&S Plans) for copies of the training certificates for individuals holding these positions (when completed).
- All of our team members will undergo a 2 hours safety training prior Solar Decathlon 2015 competition. This training consists of getting familiar with safety procedures, PPE and site organization from the safety perspective. A copy of the present Health and Safety Plan will be handed to each team member at the end of the training session.
- After any incident, there will be a debriefing at the beginning of each shift to cover any changes that will occur due to the incident.
- All members of the team will be briefed in the handling of each type of tool and will not be able to handle a tool if not properly trained in its handling.
- Basic first aid training will be completed by all members of the team attending the competition.

Hoisting and Rigging: The team member who will be receiving hoisting and rigging training and their certificate of completion will be posted here.

Electrical Training: Will be posted upon company determination. The team members who will be receiving qualified electrical worker training and their certificate of completion will be posted here.

Fall Protection: The team member who will be receiving fall protection training and their certificate of completion will be posted here.

Scaffold: The team member who will be receiving scaffolding training and their certificate of completion will be posted here.

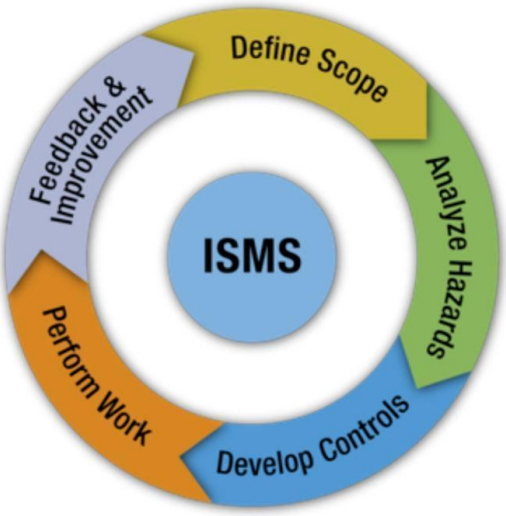
Forklift: The team member who will be receiving forklift training and their certificate of completion will be posted here.

SECTION 18 - HAZARD ANALYSIS

The following process will be used to identify potential hazards and determine the controls we will implement to mitigate these hazards.

1. Define the scope of work. Each team member/sub-contractor will be aware of their scope of work.
2. The hazards will be identified and analyzed in a group session including the Health and Safety staff, Construction Manager, and team members involved in the scope of work.
3. Controls will be developed to mitigate the hazards to an acceptable level of risk. An acceptable level of risk is a Low or Routine as per the Hazard Analysis chart.
4. The work will be performed within the scope utilizing the controls.

5. After completion of the work, lessons learned will be gathered and areas of improvement will be identified. Lessons learned from assembly will be used for disassembly.



The following chart will be used to determine the initial level of risk for each hazard, as well as the level of risk after the controls are in place.

Probability

Consequences	Frequent A	Reasonably Probable B	Occasional C	Remote D	Extremely Remote E	Impossible F
Catastrophic I	High	High	High	Moderate	Low	Routine
Critical II	High	High	Moderate	Low	Low	Routine
Marginal III	Moderate	Moderate	Low	Low	Routine	Routine
Negligible IV	Routine	Routine	Routine	Routine	Routine	Routine

Risk

When defining probability and consequences, use the following criteria:

Event Probability Classification Table

Probability (that the potential consequence occurs)		
Level	**Annual Probability**	**Potential Consequences**
A	Frequent > 1.0	Likely to occur many times during the life cycle of the system (test/activity/operation)
B	Reasonably Probable 1.0 to 0.1	Likely to occur several times during the life cycle of the system
C	Occasional 0.01 to 0.1	Likely to occur sometime during the life cycle of the system
D	Remote 0.0004 to 0.01	Not likely to occur in the life cycle of the system, but possible
E	Extremely Remote 0.000001 to 0.0001	Probability of occurrence cannot be distinguished from zero
F	Impossible < 0.000001	Physically impossible to occur

Hazard Consequence Classification Table

Consequence		
Category	**Description (Est. $ Lost)**	**Potential Consequences**
I	Catastrophic (equipment loss > 1 million USD)	May cause death or system loss
II	Critical (100,000 USD to 1 million USD)	May cause severe injury or occupational illness, or minor system damage
III	Marginal (10,000 USD to 100,000 USD)	May cause minor injury or occupational illness, or minor system damage
IV	Negligible (<10,000 USD)	Will not result in injury, occupational illness, or system damage

Use the following guideline to effectively control risks:

Activity Hazard Analysis (AHA)

An AHA shall be completed for each major task associated with assembly and disassembly of our house on the event site. An AHA meeting will be held prior to construction both at the school and at the competition to ensure all potential hazards have been considered. During construction of the house if the scope of work changes to include new potential hazards, a new AHA will be completed prior to continuing work.

Activity	Potential Hazards	Probability Prior to Mitigation	Consequences Prior to Mitigation	Precautionary Action to be Taken	Probability After Mitigation	Consequences after Mitigation
Site Preparation						
Delivery of Generator	Vehicle Hazard	B	2	Clear of people 3 feet around the marked unloading area	D	2
				Track is directed by front & rear flag conform to Part VI of the Manual of Uniform Traffic Control Devices		
Installation of Jobsite Lights	Electrocution	D	1	The fixtures are appropriate for outdoor use; with flexible cords and an attachment plug of the grounding type; installation safety shall comply with OSHA #1926.402 thought #1926.408 see Section Power cord safety and Electrical Safety OSHA #1926.403	E	1
	Lifting	C	3	Check the weight of each light and assign appropriate number of people	E	3

				to lift each light fixture		
	Heavy Falling Object	E	2	The fixtures will be firmly secured to the surface on which is mounted	F	2
Site Survey	Tripping	B	3	Survey the site and mark it with brightly colored tape	C	3
Delivery of Tool Trailer	Lifting	B	2	See Section 16 Vehicle Safety	D	2
House Delivery / Installation						
				Unknown as yet, will provide more detailed list as the project develops		
Interior / Exterior Finishing						
Interior MEP connections	Lifting	C	3	Use of a dolly to maneuver MEP equip. into position	D	3
	Electrical Hazard	B	1	Test the circuit with a min. CAT. III Multimeter	C	3
	Overhead Work	D	3	Use of a scaffolding	E	3
Int. Surfaces Finished	Hand and Power Tools	A	2	Tools will be kept in good condition, in a dedicated place and shall be inspected prior to use	C	3
	Tripping	C	4	Housekeeping	D	4
	Some Heavy Lifting	C	3	Two or three people will lift large or heavy materials	D	3
	Interior Air Quality	B	4	Appropriate Ventilation	C	4
	Appropriate Lighting	B	3	Install temporary ambient and task lighting	C	3
Furniture Installation	Tripping	B	3	Housekeeping	D	3
	Tool Safety	C	3	Tools will be kept in good condition, in a dedicated place and shall be inspected prior to use	D	3
Landscaping						
Install Exhibition Furniture	Heavy Lifting	C	2	Two or three people will lift large or heavy materials	D	3
	Tool Safety	C	3	Tools will be kept in good condition, in a dedicated place and shall be	D	3

				inspected prior to use		

SECTION 19 – SITE INSPECTIONS

The Health and Safety officer or the officer on duty will inspect the site periodically and will notify each necessary team member to address the safety hazard. Waste will be picked up at the end of each day or sooner, if necessary. A check-list with all hazard locations on the site will be put together for periodic inspections.

SECTION 20 - APPROPRIATE WORK CLOTHING AND PERSONAL PROTECTIVE EQUIPMENT (PPE)

The components part of the PPE required for anyone accessing our site while construction activities are in progress: hard hat, safety glasses with side shields, safety boots with ankle protection, long pants, and shirt with sleeves (3 in. minimum). Long hair should be tied up. Loose clothing should be minimized.

Anyone who enters the construction site will be trained on the proper use, inspection and limitations of the mandatory PPE. If additional PPE is required for specific tasks, such as specific work gloves, face shields, etc., it will be identified in the AHA.

SECTION 21 - MOTOR VEHICLE OPERATIONS

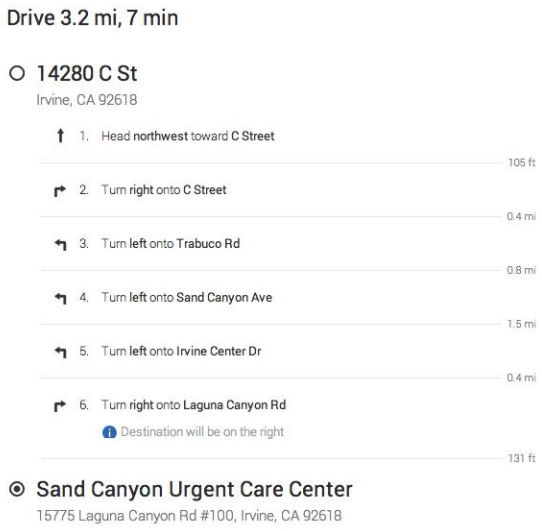
At the competition all vehicles that will be directed by our site will be in conformance with Part VI of the Manual of Uniform Traffic Control Devices and will be guided by both a front and rear flagger. An area of 3 feet will be kept clear around the vehicle at all times.

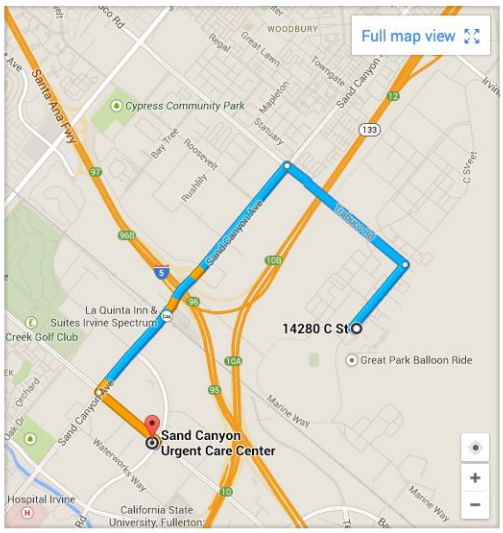
A walking escort/ spotter will accompany the truck while on the delivery path. The track will be equipped with adequate audible reverse warning alarm. Spotters will walk with all vehicles along the path from the entrance of the Solar Decathlon site until the site of the house at the competition.

The materials on the vehicle will be securely fastened to protect from falling objects. The employee of the professional house moving delivery company will have a valid certification for such operations and will carry professional insurance.

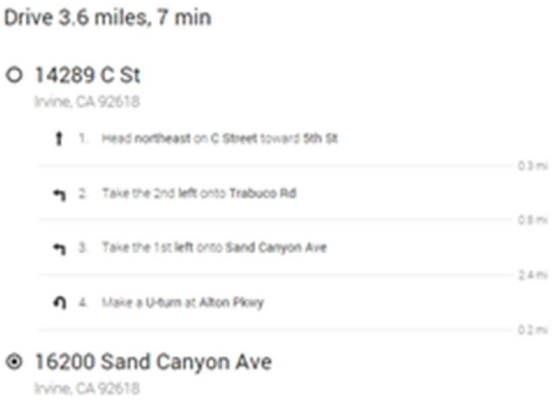
Information regarding the company being used will be shown in later versions of the document.

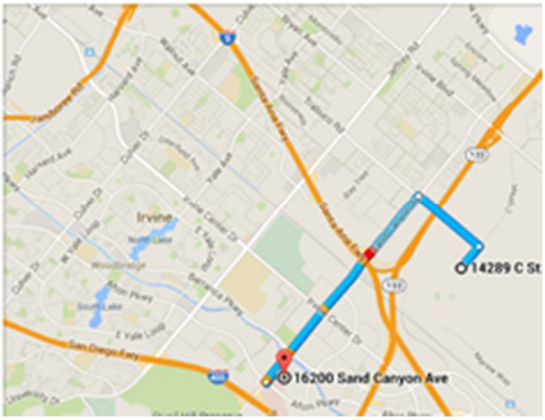
Appendix 1:
Nearby Hospital and Emergency Rooms
Sand Canyon Urgent Care Center
15775 Laguna Canyon Rd #100
Irvine, CA 92618
scucmc.com
(949) 417-0272



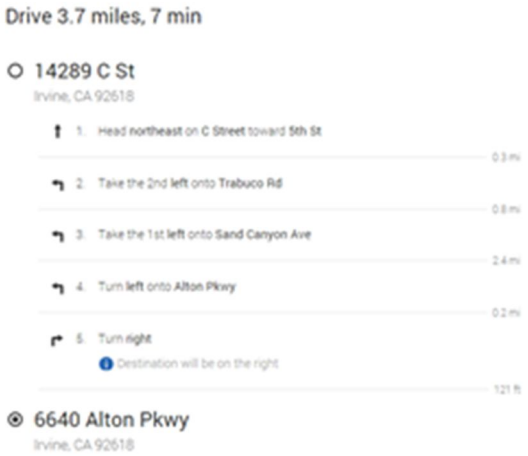


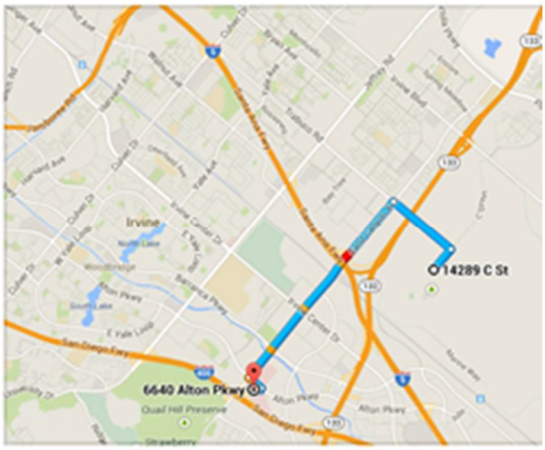
Hoag Hospital Irvine
16200 Sand Canyon Avenue
Irvine, CA 92618
http://www.hoag.org/Locations/Pages/Hoag-Hospital-Irvine.aspx
(949) 764-4624



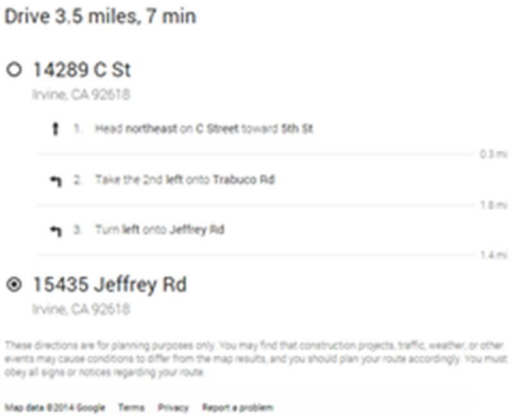


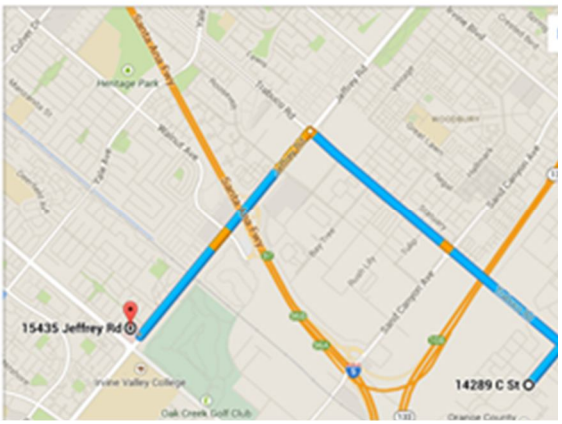
Kaiser Permanente, Orange County-Irvine Medical Center
6640 Alton Parkway
Irvine, CA 92618
http://southerncalifornia.kaiserpermanente.org/orangecounty/locations/orange-county-irvine-medical-center/
(949) 932-5000





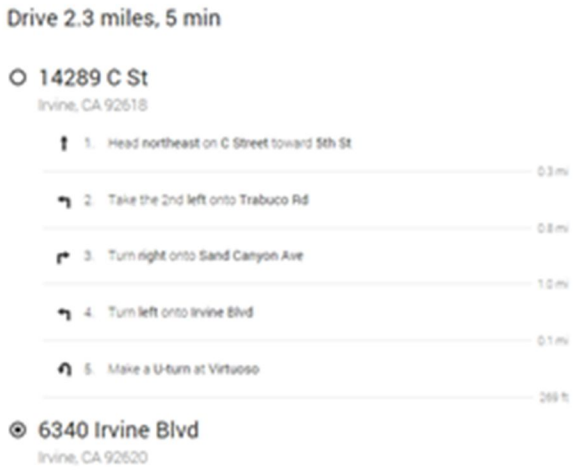
Irvine Village Urgent Care Medical Clinic
15435 Jeffrey Road #127
Irvine, CA 92618
(949) 654-8455

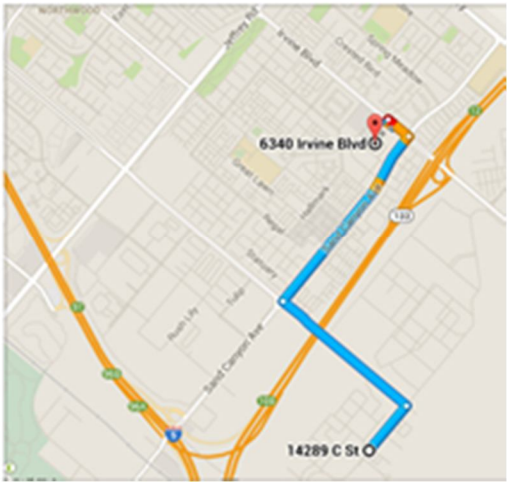




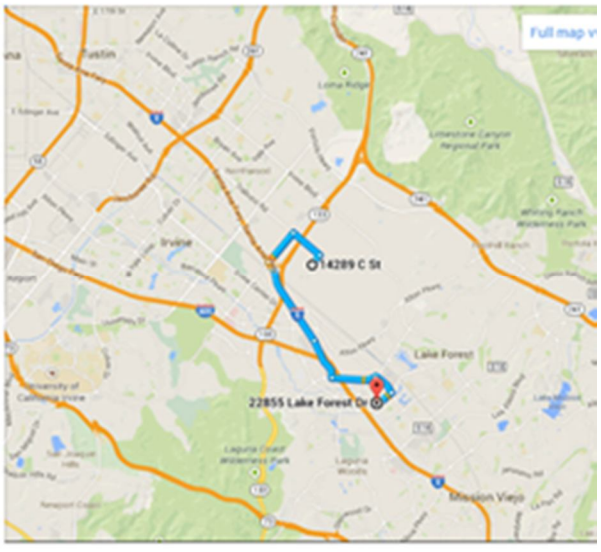
Woodbury Medical Group
Hoag Health Center at Woodbury Town Center
6340 Irvine Boulevard
Irvine, CA 92620

http://woodburymedical.com/
(949) 559-6500





Saddleback Family & Urgent Care
22855 Lake Forest Drive #a
Lake Forest, CA 92630
http://www.memorialcare.org/locations
(949) 452-7544



Appendix 2:
MSDS Sheets
This section to be updated upon determination of necessary sheets needed for home.

Appendix 3:
Certificates of Training
This section to be updated upon completion of trainings mentioned in above report.