

AIChE's Student Chapter Competition for 2007: Chem-E-Car Competition

Sponsored by General Mills

Based on *Rules Updated - 2 February 2007*

2007 Chem-E-Car Competition Timeline

Timeline	Date	Item
1		For regional competitions: Plan Chem-E-Car vehicle using approved safety procedures. A JSA form must be filled out and appropriate approvals obtained. Instructions will be provided.
2		Design, build & test car following approved safety procedures specified at each university and the national Chem-E-Car competition.
3	various dates	Regional Competitions.
4		Revise and modify cars following approved safety procedures specified at each university and the national Chem-E-Car Competition.
5	1-May-07	Website opens for National Competition application submission. http://interact.hpcnet.org/sdsmforms/aiche/register.htm
6	1 May - 30 Jun 2007	Regional qualifiers must submit entry on website to National Competition and pay \$100 entry fee. Submissions for open slots will also be received and placed on waiting list.
7	30 Jun 2007	Eligible team's Student Chapter Annual Report must be completed via web submission http://www.aiche-xtranet.org/aichereport/default.asp?CatID=2
8	30 Jun 2007	Closing date for submissions for regional qualifiers for the National Competition. Decision on number of open positions will be made.
9	30 Jun 2007	\$100 entry fee due from regional qualifiers for the National Competition.
10	1 Jul – 30 Sep 2007	Additional time period for acceptance of applications for open positions for the Chem-E-Car Competition. Accepted open positions entries must pay \$100 entry fee prior to 30 Sep 2007.
11	30 Sep 2007	Closing date for all open position entries for the Chem-E-Car Competition.
12	1 Oct 2007	Closing date for Web Application of Chemical Usage and JSA.
13	19 Oct 2007	All chemicals must be received by close of business at designated receiving location.

The objective of this competition is:

- To provide chemical engineering students with the opportunity to participate in a team-oriented hands-on design and construction of a small chemical powered model car.
- To design and construct a car that is powered with a chemical energy source that will carry a specified load over a given distance and stop.
- To encourage students to become actively involved in their professional society.
- To increase awareness of the chemical engineering discipline among the general public, industry leaders, educators and other students.

There are two general competitions. The first is held at spring regional conferences and the second is held at the AIChE Annual Meeting. Each year the annual competition is held in conjunction with the Annual Student Conference at the site of the AIChE Annual Meeting. A host AIChE chapter, along with the national AIChE staff and the competition sub-committee from the Student Chapters Committee, and SACHE, provides support for the annual competition.

There is a poster session and a distance or performance session at each competition, as detailed below. Each year the rules may be modified to address concerns that have developed at the past regional and annual competitions. The rules listed below have been significantly modified, so be sure to read all of them carefully.

Competitions

Regional Conference Competitions

1. In general, a school can have any number of entries at the Regional Conference. However, the Host School has the right to set a limit, should the need arise.
2. The rules listed under the National Conference Competition shall apply for the regional conference competition.
3. Regional conference host school organizers should contact the National ChE Car Rules Committee (see below, after item 12) with questions or for clarification on the competition rules.

Regional Conference awards:

Poster Competition:

- Ribbons for 1st, 2nd, and 3rd place
- Ribbon for Most Creative Drive System
- Ribbon for Most Creative Vehicle Design

Performance Competition:

- 1st place: \$200 and Ribbon
- 2nd place: \$100 and Ribbon
- 3rd place: Honorable mention and Ribbon
- Ribbons for 4th and 5th place finishers
- Ribbon for Spirit of Competition

National Conference Competition

There will be a maximum of 31 car entries at the 2007 National Conference. The list of national entries is drawn from regional winners, based on the size of each region. Each Student Chapter Region may send their first and second place winners at the minimum. Mid-America, Northeast, Rocky Mountain and the Western regions may send their 1st, 2nd and 3rd place winners. The Mid-Atlantic, North Central, and the Southern Regions may send their top five winners. While multiple entries from a single school may be permitted at the regional competitions only one entry per school, via this qualifying procedure, is allowed at the national competition. Multiple entries per school may be allowed following the open entry procedure outlined in the following paragraph.

Submit your application online: The eligible winners from the Regional Conference Competitions *must submit an application to compete in the national competition at the 2007 AIChE Annual Meeting in Salt Lake City, UT.* Applications should be made by [Web application](#) by June 30, 2007. If an eligible chapter does not submit their application by the above deadline their competition slot will be opened up to any ChE car team from any region that wishes to compete. To facilitate this, interested teams who are not regional winners should submit their application by June 30, 2007; however, entries will be accepted through September 30, 2007. Applications will start on 1 May 2007. On July 1, 2007, any open entry slots will be allocated on a "first come" basis; however, preference will be given so that there will be only one team entry per student chapter. For this year's national competition a \$100 entrance fee will be charged for each competing team. This entry fee was added to cover the cost of the disposal of chemicals at the competition site. This entry fee must be paid to AIChE as given below:

Web application to Compete in Nationals (1 May 2007 – 30 June 2007)

Applications should be made by **Web application** to compete in nationals--
<http://interact.hpcnet.org/sdsmtforms/aiche/register.htm> -- and should include:

- Student Chapter Name
- Point of contact for the team (name, phone number, email address)
- List of team members
- Title of entry
- General description of chemical reaction(s) / drive system (at least 1 or 2 paragraphs so the judges can understand any potential safety issues involved.)
- Regional Conference (and place) where the team competed
- Place earned in the regional performance competition, or indicate applying for open-slot
- National Competition Fee of \$100. (See web for details)

Web Application: Chemical Usage (Deadline: 1 October 2007)

- Sign-up for safety training for 2008
- List of chemicals (common name, IUPAC name, and Chemical Abstracts Service number [CAS number]) to be used and estimated quantity needed (see Rule 12 below)
- Completed Job Safety Analysis using required form (JSA)

Questions about the application process should be sent to:

Professor David Dixon
Dept. Chemical and Biological Engineering
South Dakota School of Mines and Technology
501 E. St. Joseph Street
Rapid City, SD 57701
Work Phone: (605) 394-1235, FAX (605) 394-1232
Email: david.dixon@sdsmt.edu

There are two sessions of the National Chem-E-Car Competition: a poster competition and a car performance competition.

Poster Competition

a. A poster board must be displayed with the autonomous vehicle on the day of the competition. This poster should describe how the car is powered using the chemical reaction, the unique features of the car, and environmental and safety features in the design. Appropriate documentation on the design and testing of your vehicle must be available for inspection by the judges at the poster competition. This documentation must include:

- vehicle design description and drawings
- testing results
- Job Safety Analysis Form, given below
- Material Safety Data Sheets (MSDS) for each chemical used by the entry
- calculation of relief valve size and evidence of hydraulic pressure testing if required, see below
- procedures for transportation of vehicle and related accessories
- letter from student chapter advisor or department chair stating that to the best of his/her knowledge that the students abided by the rules.
- If obvious safety violations have occurred, the judges will disqualify the entry. Entries will also be judged on creativity in the propulsion system and the appearance of the vehicle.

b. The poster competition and judging will occur prior to the ChE Car Performance Competition. Team members should be present during judging to answer questions from the judges.

c. A team must achieve a minimum score of 70% in the poster competition to be able to advance to the ChE Car Performance Competition. Posters will be judged according to the following criteria, with a maximum of 20 possible points:

- Description of the chemical reaction / power source (20%)
- Design creativity and unique features of the vehicle (20%)
- Environmental and safety features (40%)
- Quality of the poster and team member presentations (20%)

d. Winners of the poster competition will be announced at the end of the performance competition:

- 1st, 2nd and 3rd place plaques will be awarded.
- A plaque will be awarded for Most Creative Drive System
- A Golden Tire plaque will be awarded for the Most Creative Vehicle Design
- Society of Biological Engineers Award for Best Use of a Biological Reaction to Power a Car
- SChE Safety Award for the best application of the principles of chemical process safety to the Chem-E-Car competition.

Chem-E-Car Performance Competition:

1. Load and Distance:

Each car will be given two opportunities to traverse a specified distance carrying a certain additional load. The required load and distance will be given to each team one hour prior to the start of the performance competition. The distance will be between 15 and 30 m \pm 0.0127 m (50 - 100 ft \pm 0.5 in.) and the load will be between 0 and 500 ml of water. A judge from the student host chapter will measure out the prescribed water for each team. Teams may not add or remove any "load" (or other inert items) to adjust their vehicle weight once the poster session has concluded. Teams are allowed to adjust "fuel" or reactants used in the car's chemical reaction.

2. Course Layout and Distance Measurement:

The car will start with its front end just touching the designated starting line. There will be a designated finish line. The distance will be measured with respect to the front most point of the car. The goal of the competition is to have your car stop closest to the specified finish line (in bounds) while carrying the specified load. The course should be wedge-shaped with a starting line and the prescribed distance clearly marked in an arc of constant distance from the starting point. The physical site will dictate the exact course layout. See Figure 1 for an example of the course layout. A vehicle that goes outside the course will have its distance measured to where it

went out of bounds, and a penalty of 3.048 m (10 feet) will be added to the measured distance. When measuring the distance from the finish line it does not matter if the car goes longer or shorter than the prescribed distance.

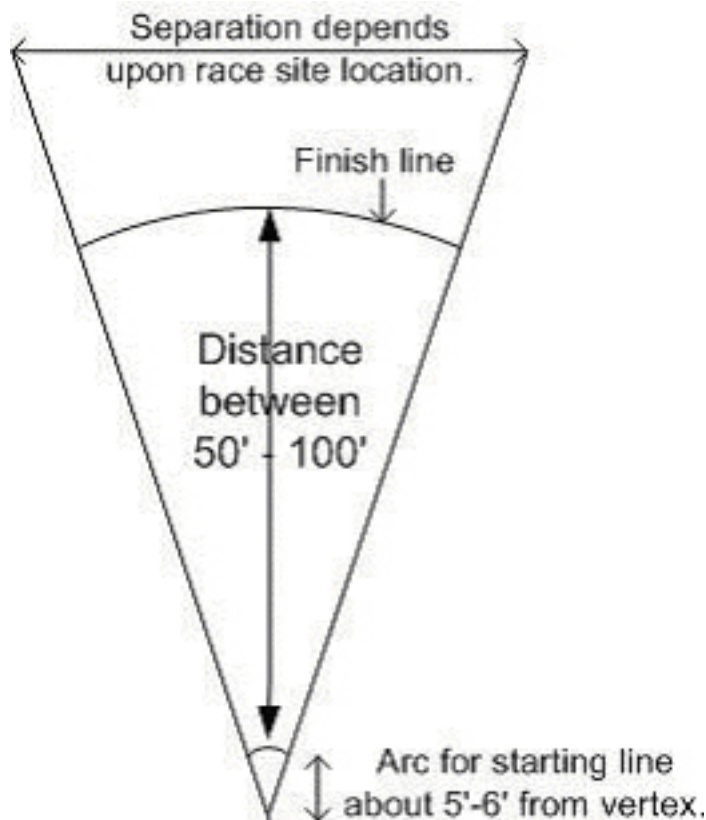


Figure 1. Sketch of typical performance course layout

3. Race Logistics:

A Chem-E-Car Competition judge (or MC) will announce each team just prior to the start of their run. Each team will be asked to introduce its entry to the audience, giving the school name and briefly mentioning the propulsion system. Each car will have two (2) attempts to complete the course, each attempt lasting no more than two (2) minutes. The best score of these two attempts will be used in the judging. In the event a team fails to show up on the starting line, or the vehicle fails to start, the next team in the order of the competition will be announced and requested to proceed to the starting line. The order of the teams in the first round of competition will be determined by random drawing. There will be a short break at the completion of the first round before the second round begins. The competition order in the second round will be determined by the 1st round standings, beginning with the team that is farthest from the prescribed distance and ending with the team that was closest.

4. Starting Procedure:

Each car is guaranteed a maximum competition time of two (2) minutes. The car must start moving, traverse the distance, and come to a stop within this time interval. If the car goes out of bounds, the next team must be ready to start its run as soon as the MC invites the team to the starting line. Since the run time of cars that go out of bounds or do not start may be less than two minutes, the next car in the order of the competition must always be ready to run at a moment's notice. If a car does not stop within the 2-minute period, then it is disqualified from that round of the competition.

5. Competition Order Logistics:

The purpose of the time restrictions is to allow 31 cars to compete at the national competition within the period allotted for the event. In past competitions, we have had cars compete in a period of two hours.

5.1. Team start order is determined during the poster competition.

5.2. The order for the first round may change because of disqualifications. If a car is disqualified that was scheduled to start before your car, then you will move-up one position in the start order earlier than was originally scheduled.

5.3. The load and distance are announced one hour before the competition starts.

5.4. Five (5) minutes before the start of the competition, the first three (3) teams are called to the start. The first team will be at the start line, the second team at ready, and the third team at the water load check station.

5.5. The first team is given a one-minute warning before the competition starts.

5.6. The competition starts when the MC signals the timing to begin. The first team is given 2 minutes for the car to start moving, traverse the distance and stop. When the car stops, the timer is reset for the next competitor. The timing will also stop if the car travels out of bounds. If the car does not stop within the 2-minute period, then it is disqualified from that round of the competition.

5.7. After the car for team 1 stops, the distance traveled is measured. During the distance measurement, team 4 is called and each team moves up one position. Team 1 should take their car directly to the chemical disposal station to dispose of their spent chemicals. This disposal process is repeated for each car upon completion of its run.

5.8. After the measurement is completed, team 2 is told to start their car, and has 2 minutes to complete the run. When the car stops, the timer is reset for the next competitor. The timing will also stop if the car travels out of bounds. If the car does not stop within the 2-minute period, then it is disqualified from that round of the competition.

5.9. During the distance measurement of team 2, team 5 is called and each team moves up one position. The process is continued until all qualified cars have competed once in the competition.

Note that if every car took two minutes to complete the course, then the competition for 31 cars would take a minimum of 124 minutes, which is more than the two hours allotted for the competition. To enable the competition to proceed in a timely fashion, it is recommended that the next team to compete should be ready and at the staging area at least five (5) minutes before their anticipated run time. Upon the completion of the run of the previous team, the next car should be ready to start.

6. Vehicle Drive System:

An objective of this contest is a demonstration of the ability to control a chemical reaction. The only energy source for the propulsion of the car is a chemical reaction.

6.1. Vehicles entered into the competition must have a significant and demonstrable student design component, particularly with respect to the vehicle drive system, and the starting and stopping mechanisms. Any vehicle that is purchased from a vendor without major modifications to its operation will be disqualified. For example a team could not purchase a fuel cell car and race this car without any modifications. (e.g. Thames and Kosmos - Fuel Cell Kit -- <http://www.thamesandkosmos.com/products/fc/fc2.html>).

6.2. No commercial batteries: (for example, AA batteries) are allowed as the power source. Commercial batteries are allowed for specialized instrumentation (e.g. detectors, sensors)

6.3. Autonomous vehicle: The car must be an autonomous vehicle and cannot be controlled remotely. Pushing to start the vehicle or using a mechanical starting device is not allowed. Check with the Rule Coordinators (see below, after item 12) if you have a specific question concerning your vehicle.

6.4. No brakes: No mechanical force can be applied to the wheel or ground to slow or stop the car (e.g. no brakes).

6.5. Mechanical or electronic timing devices: There can be no mechanical or electronic timing device(s) to stop the chemical reaction or stop the car. In addition, a timing device can not utilize what is normally considered as an instantaneous reaction. For example, a constant, or draining, liquid feed to a sensing cell that employs an instantaneous reaction (acid-base or precipitation) would not be allowed. Another example would be a liquid draining out of a vessel to serve as a stop switch would be considered a mechanical timing device, and would not be allowed.

6.6. No flames and/or smoke: All cars are restricted from having any open flames or emitting any smoke. The ChE Car Competition judges reserve the right to ask any vehicle for a "test" run prior to the contest (possibly during, or just after, the poster judging phase) to insure that all safety rules are met by all competitors.

6.7. No internal flames: Cars shall not have internal flames. The only exception to this rule is the use of a commercial internal combustion engine that uses an alternative fuel that is synthesized by students. Succinct safety procedures for the maintenance and operation of this engine must be demonstrated by the team. In addition, use of an internal combustion engine must show a demonstratable and significant student design component.

6.8. Pressurized vessels and components: Every vessel that will have a pressure over 2 ft of water (0.87 psig) must meet the requirements given in this section. Appropriate documentation must be available for the judges to examine during the poster competition.

6.8.1. Hydraulic Testing: Evidence that the system has been hydraulically tested for pressures up to 1.5 times the maximum allowable working pressure (MAWP). The maximum allowable working pressure is the highest pressure anticipated within the system during normal operation. For example, a proposed reaction, when operating the car with its heaviest load (500 grams water) and longest distance (100 ft), can create up 200 psig using the ideal gas law, and assuming complete reaction. This defines the MAWP. Then, the system has to be hydraulically tested holding 300 psig for 30 minutes.

6.8.2. Pressure testing: The manufacturer recommendations for the use of all pressurized components, **especially plastic components**, for a vehicle must be thoroughly researched and documented. This includes following manufacturer's recommendations for use of materials. **The use of PVC, cPVC or polyethylene terephthalate (PETE or PET) for pressurized gases is prohibited in this competition.** All of these three types of plastics have microscopic defects that result in hoop stress failure. If other types of plastic components are used for pressurized gases such as ABS (Acrylonitrile-Butadiene-Styrene), Nylon, or Teflon (PTFE), then the manufacturer's specifications should be consulted as well as evidence of proper/adequate hydraulic testing be conducted. [CAUTION: Some teams in the past have had soda bottles (PETE), or PVC vessels explode when pressurized with a reaction that creates a gas! Please note that PVC is only rated by ASTM D 1785 – 05 as schedule 40 for water at temperatures less than 73°F and is not recommended for use with pressurized gases.]

6.8.3. Pressure gauge: The vessel (when the pressure exceeds 2 ft of water pressure) must have a pressure gauge that reads from 0 psig to 2 times the maximum operating pressure. For the example in 6.8.1, the appropriate pressure gauge range is 0 to 400 psig.

6.8.4. Emergency Relief Device: Have an industry standard relief valve that is appropriately sized, and is set at 1.1 times the maximum operating pressure. The maximum operating pressure is typically defined as the pressure that would need to be generated to propel the vehicle 100 ft. and carry a load of 500 ml. For the example given in 6.8.1, the set pressure of the relief valve (the point when the relief valve opens) is 220 psig. The relief valve must vent to a containment device. This valve must be tested and evidence must be provided in the safety documentation. Size the relief devices per Crowl and Louvar, "Chemical Process Safety", Prentice Hall PTR, Upper Saddle River, NJ, 2002, or equivalent (See also the SACHE product: Emergency Relief system Design for Single and Two-Phase Flow, 2nd Ed. by Ron Darby. This can be downloaded by SACHE members at <http://www.sache.org>. (Ask your AIChE faculty advisor for this manual and Excel spreadsheets.) The design scenario for the emergency relief device must be clearly stated. For example, state the amount of reacting material assumed, the concentration of reacting material, the initial temperature, and any consideration of operating error such as overcharge, use of wrong material, or wrong concentration, and, if so, what is the "design case" error, etc? Also, the emergency relief system calculations must be included in the documentation and they must be reviewed and approved by a faculty representative.

6.9. Liquid discharge: No liquid discharge is allowed. The vehicle drive system can be propelled by liquids or vapors; however, the system must be designed to prevent any liquid exiting with the vapor. Any liquid on the vehicle must be contained and not allowed to discharge from the car. Any vehicles that result in a release of liquid or have a significant risk of discharging liquids will be disqualified. Emissions of vapors must be identified and the hazards accessed. Given the general public's lack of understanding of general chemistry, anything that is visibly left behind or odorous may well be construed as chemical pollution, and even hazardous.

6.10. Containment: Any car using or producing a corrosive chemical(s) must have the chemical(s) sealed in a container, or at least use a spill-proof container.

6.11. Redundant containment: Vessels containing corrosive or reactive fluids that have an NFPA rating of 2 or higher must have external redundant containment as a component of the vehicle. In addition, all vehicles must have an

external containment system (not integral to the vehicles) for possible spills while charging and discharging of chemicals at the competition site. The vessel needs to be able to be inspected by the judges at the competition site.

6.12. Wiring: All wiring must be covered to prevent the possibility of ignition of any component of a vehicle. Alligator clips or similar devices are not permitted.

6.13. Guards for fast moving parts: Guards must be present for fast moving parts and pinch points (meshing gears, belts, etc.).

7. SAFETY

7.1 Job Safety Analysis (JSA) Documentation:

Each team will prepare and post a Job Safety Analysis on the poster board whenever the car is entered into competition. When preparing this JSA, the students should focus on identifying and explaining how the hazards will be eliminated or reduced to an acceptable level. The required Job Safety Analysis form is available here:

http://www.aiche.org/uploadedFiles/Students/Conferences/07_ChECar_JSA_Ver4.doc

7.2. Safety Documentation:

Each team will prepare and have available safety related documentation for their vehicles. This documentation must include the JSA, calculations, experimental test results related to the safe operation of their vehicle. In addition, this documentation must demonstrate that the university has overseen the design, fabrication, testing and modification of the car. Documentation showing that these procedures have been followed must be properly dated and signed by appropriate faculty and students. If appropriate documentation is not provided at the poster competition, then the vehicle will be disqualified.

7.3. MSDS:

Each team must have a MSDS for each chemical it is using. If obvious safety violations have occurred, the judges have the discretion to disqualify the entry. If there is an uncertainty on an issue of safety, contact the national rules coordinators: Professors Skip Rochefort, Robert Ofoli, or George Roberts – see contact information below under item 12.

7.4. Personal Protective Equipment:

Appropriate personal protection (particularly safety glasses and gloves) must be worn by those team members operating the vehicle.

7.5 Safe Operation

All cars must safely operate inside a building. If a car is deemed unsafe, then it will be disqualified. Vehicles that are disqualified at regionals cannot compete in the national competition unless they can demonstrate they have corrected the

problems from the regional competition. The national competition judges at the competition site have the final say in regard to disqualifications, regardless of whether a car passed safety inspections at the regionals. If there is a safety incident that occurs during the competition, then the AIChE student chapter advisor of that team will be informed that an incident analysis report must be submitted to the head of the Chem-E-Car Student Chapters Subcommittee, David Dixon (address and contact info above). This safety incident report must be approved by the Chem-E-Car Student Chapters Subcommittee before any team from that university can compete in Regional or National Chem-E-Car Competitions.

8. Transportation of Vehicle and Chemicals:

8.1 Transportation of Vehicle

Students are responsible for transportation or shipping of their vehicles to the competition sites. If shipping the vehicle, they must be received by the close of business on the Wednesday before the competition. Provisions by the student team must be made to restore their car to a state that is approved for transportation to and from their university for each competition. Check this website for more details on shipping to the national competition. For regional competitions, contact the host school for more information.

8.2. Chemical Shipment and Usage:

Teams are expected to follow DOT regulations in the transportation of any chemicals. For the national competition the team is required to ship the minimum amount of material to the competition. For example it is suggested to ship no more material than what is required for 5 runs. **Chemicals must only be shipped to the designated holding facility that will be specified by the Host Chapter of the Chem-E-Car Competition. All chemicals must be received at the designated holding facility 9 days before the Chem-E-Car Competition.** For this years competition the chemicals must be received by Friday, 26 October 2007. Chemicals can not be stored in hotel rooms. Contact the host chapter or check this website for the latest information on where chemicals may be stored at the national competition site. For regional competitions, the host chapter will designate rules for the proper shipping and receiving of chemicals. In all cases of both national and regional competitions Department of Transportation rules must be followed.

In order to facilitate the safe use of chemicals at the competition site, a designated area will be identified where teams must mix or prepare their chemicals (unless the material was shipped pre-mixed). All chemicals will be made available to the teams in the chemical preparation area at least 2 hours prior to the performance competition. Unfortunately, due to hotel safety regulations it is not possible to allow teams to do "trial runs". Teams that violate these safety rules jeopardize the

continued operation of the ChE Car Competition and may be disqualified by the judges.

Certain other basic chemicals and materials may be available onsite. At the competition, chemical waste disposal will be provided by the host chapter.

Student teams are responsible for entering on the web form a COMPLETE list of the chemicals they plan to use, no later than 1 October (for the national competition). Past host chapters have made arrangements with local chemical supply firms or local chemistry department stockrooms for procuring and/or disposing chemicals. Hazardous chemical protocols must be followed and reported on the poster.

*(2007 National Competition shipping instructions --
To become available in Summer 2007)*

9. Size of Car:

All components of the car must fit into a shoebox of dimensions no larger than 40 cm x 30 cm x 18 cm. The car may be disassembled to meet this requirement. If the judges are uncertain whether the car will fit inside the box when disassembled, they may request that the team demonstrate that they can do this.

10. Water Load Container:

The car must carry a container that holds up to 500 mL of water without spilling. An example container is a Nalgene Low-Density Polyethylene Narrow-Mouth Bottles (500 mL) Nalge No. 38-430 20039016 or Fisher Cat. No 02-923-11G. At the competition, only the water will be supplied, thus each car must already have its own container.

11. Capital Cost of Vehicle:

The cost of the contents of the "shoe box" and the chemicals must not exceed \$2000. The vehicle cost of the car includes the donated cost of any equipment. The time donated by university machine shops and other personnel will not be included in the total price of the car. It is expected that every university has equal access to these resources. The cost of pressure testing is also not included in the capital cost of the car. The method used to estimate the donated cost of the equipment must be shown. It is expected that standard financial procedures will be used to estimate this cost. **The same car can not be reused from year to year.** Substantial changes should be made and indicated in the poster presentation.

12. Team Member Status and Conduct:

12.1. All team members attending the National Competition must be National AIChE members.

12.2. The competition will be conducted on the honor system. Faculty and graduate students can only act as sounding boards to the student queries. The faculty cannot be idea generators for the project.

12.4. The students working on the project must sign a statement saying they have abided by the rules. This statement must be included (or be available) at the poster competition.

12.5. This is a team competition and must have students from at least two chemical engineering classes. The percentage of students from any one class must not be greater than 80% of the total number of students on the team. Multi-disciplinary teams are also encouraged.

12.6. The minimum team size is five (5) participants. All team members do not have to be present at the National ChE Car Competition; however, all are encouraged to attend, if possible.

12.7. Each Chem-E-Car team must have a faculty member and student team member that has undergone AIChE approved safety training.

12.8 All Chem-E-Car team members must have received appropriate safety training by the university.

12.9 All student chapters that are competing in the national competition must have submitted a Student Chapters Annual Report online to AIChE following the standard timelines given by AIChE.

If there is any uncertainty on an issue of safety or other judging criteria, please contact:

Rules Coordinators: (Contact these folks first if you have questions on the rules.)

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13. Declaration of the Winning Team:

The winning team is the car that stops closest to the finish line. This is defined as the absolute value of the distance between the front most part of the car and the finish line. In case of ties, the team with the best average from the two runs will be declared the winner.

Winners of the National Chem-E-Car Performance Competition will be recognized immediately following the performance competition. General Mills sponsors the National ChE Car Competition. The National awards are:

- 1st place: \$2000 and a trophy
- 2nd place: \$1000 and a trophy
- 3rd place: \$500 and a trophy

In addition to the top three performance awards, other awards will be given as described below:

- **Best Use of a Biological Reaction to Power a Car - \$1,000 Prize:** Sponsored by the Society for Biological Engineering
- **SACHE Safety Award** for the best application of the principles of chemical process safety to the Chem-E-Car competition.
- **Most Consistent Performance** - This award is based on the best average score for the two runs that the vehicle makes. It has been created to recognize the team that has designed and most understands the performance of the reaction that powers the vehicle. Award consists of a plaque.
- **Spirit of the Competition** - This award is given to the team displaying the most team spirit as decided by a panel of judges. Award consists of a plaque.
- **Most Creative Drive System** - Recognition is awarded to the team that has designed and installed the most creative propulsion system. The winner is decided by a panel of judges during the poster competition. Award consists of a plaque.
- **Golden Tire Award** - In 2002, Northeastern University team members created this award to recognize the team with the most creative vehicle design. The national committee has adopted this as an annual award. The winning entry is decided by a ballot cast by each team entered in the competition. Award consists of a plaque.

For more information on this competition, contact AIChE at (212) 591-7107, studentchapters@aiiche.org, or by fax at (212) 591-8882.

This document was prepared and revised by a subcommittee of the Student Chapters Committee with members Sid Sapakie, H. Scott Fogler, Robert P. Hesketh, Dick Zollars, Chuck Coronella, Robert Ofoli, George Roberts, Skip Rochefort, Jim Smith, Scott Berger, and Dave Dixon, chair. In addition, the Chem-E-Car Subcommittee of SACHE contributed the Job Safety Analysis Form and additional rules to ensure the safe operation of all cars. The SACHE subcommittee was chaired by Joe Louvar with members Dennis Hendershot, Dan Crawl, Bob Rosen, and Ron Willey.