UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

VOTE SHEET

Date: OCT -4 2001

TO : The Commission
Todd Stevenson, Acting Secretary

FROM : Michael S. Solender, General Counsel
Stephen Lemberg, Assistant General Counsel
Patricia M. Pollitzer, Attorney

SUBJECT : Petition HP 01-02 requesting exemption for rocket powered model cars

Attached is a briefing package from the staff concerning a petition submitted by Centuri Corporation requesting that the Commission issue a rule exempting model rocket propellant devices to be used for model rocket ground vehicles. The staff recommends that the Commission deny the petition.

Please indicate your vote on the following options.

I. Grant Petition HP 01-02 and direct the staff to begin developing a draft Federal Register notice.

_____ _____
Signature Date

II. Deny Petition HP 01-02 and direct the staff to prepare a letter of denial to the petitioner.

_____ _____
.Signature Date

CPSA 6 (b)(1) Cleared
10/4/01
No Mfrs/PrvtLblrs or Products Identified
Excepted by Letters
Firms Notified,

NOTE: This document has not been reviewed or accepted by the Commission.
Initial ____ Date 10/4/01

III. Defer decision on Petition HP 00-1.

_____ _____

Signature Date

IV. Take other action (please specify):

_____

_____

_____

_____ _____

Signature Date

BRIEFING PACKAGE
PETITION HP-01-02
MODEL ROCKET CARS

For further information:
Terrance R. Karels, Project Manager
Directorate for Economic Analysis
(301) 504-0962 x1320

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UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: OCT -4 2001

TO : The Commission
Todd A. Stevenson, Acting Secretary

THROUGH: Caroline J. Croft, Executive Director
Michael S. Solender, General Counsel

FROM : Ronald L. Medford, Assistant Executive Director, EXHR RLM
Terrance R. Karels, Economic Analysis, Proj. Mgr. TRK

SUBJECT : Petition HP 01-02 --- Rocket Powered Model Cars

ISSUE

At issue is whether to grant a petition to allow an exemption from the Federal Hazardous Substances Act for model rocket propellant devices for use in model rocket cars. The exemption is sought by Centuri Corporation/Estes Industries, of Penrose, Colorado. (TAB A)

BACKGROUND

Current Regulation

Model rocket propellant devices (also called motors or engines) are banned under the provisions of Section 2(f) of the Federal Hazardous Substances Act (FHSA). However, in 1969, an exemption was granted to allow for the sale of model rocket motors for use in light weight rockets, provided (among other conditions) that they are ignited by electrical means, contain no more than 2.2 ounces of propellant and produce less than 80 newton-seconds of total impulse. Also exempted from the FHSA are solid fuel pellets for model airplanes, speedboats, racing cars,

and similar models, again under certain conditions. These exemptions are at 16 CFR, Section 1500.85.

Petitioner's Contacts with Staff

On October 3, 2000, Centuri Corporation contacted the CPSC's Office of Compliance (CA) regarding model rocket cars that the firm was developing. These cars would use rocket motors as propellant devices. The firm asked to be allowed to market the cars under the existing exemptions to the FHSA. (TAB B)

In support of this request, the firm presented design concepts to CA and other staff on November 7, 2000. The firm's submissions included two prototype cars, marketing and human factors information, and labeling and packaging concepts. The staff expressed general concerns about the overall safety of the prototypes (which would travel along a horizontal path rather than up and away from users and observers, as do model rockets), and a more specific concern over the permanence of the motor mount's attachment to the tether line that guides the car on a straight path. Following the November 7 meeting, CA staff determined that it would not exercise enforcement discretion to permit these products to be distributed, and that these products would continue to be subject to the FHSA ban. That advice was forwarded to the firm.

Subsequently, on January 23, 2001, Centuri petitioned the Commission for exemption from the FHSA for model rocket motors to be used in model cars. The request was docketed as a petition by the Office of the General Counsel. A notice was published in the **Federal Register**, soliciting public comment on the petition. The comment period closed on May 7, 2001. No comments were received.

Following submission of the petition, the firm continued to supply additional information to the staff. On May 22, 2001, the firm sought a stay of enforcement for the prototype products, pending resolution of the petition. This request was made to CA and to the Commission directly. The Commission voted to deny this request.

The Petition

The petition seeks an exemption for **rocket propellant devices** (i.e., model rocket motors) that would be used to propel lightweight surface vehicles such as model rocket cars, provided that the devices:

- are designed to be ignited electrically from a minimum distance of 15 feet; [1]
- contain no more than 1.1 ounces (or 30 grams) of propellant material, and produce no more than 4.48 pound-seconds of total impulse with a thrust duration of not less than .05 seconds;
- are constructed such that all chemical ingredients are preloaded into a cylindrical paper or similarly constructed nonmetallic tube that will not fragment into sharp, hard pieces;
- are designed so that they will not burst under normal conditions of use, are incapable of spontaneous ignition, and do not contain any type of explosive or pyrotechnic material other than a delay and small recovery system activation charge;
- and bear labeling and include instructions providing adequate warnings and instructions for safe use.

And, provided that the **model rocket cars**:

- are lightweight and constructed mainly of materials such as balsa wood or plastics that will not fragment into sharp, hard pieces;
- are designed so that the engine mount is meant to be permanently attached by the manufacturer to a track or track line that will provide control of the vehicle's direction for the duration of its movement;
- are not designed to carry any type of explosive or pyrotechnic material other than the model rocket motor used for primary propulsion;
- are designed to use a braking system such as a parachute or shock-absorbing stopping mechanism;

[1] This provision is consistent with requirements developed by the National Association of Rocketry, for flyable model rockets.

- and bear labeling and include instructions providing adequate warnings and instructions for safe use.

In general, the proposal for the motors is consistent with the requirements for the FHSA exemption for rocket motors used in model rockets. There are, however, two differences. First, the proposal specifies a length of 15 feet for the electrical system (no length is specified in the model rocket exemption). Second, the current exemption limits the amount of propellant material to 2.2 ounces (or 62.5 grams); the model rocket car application would be limited to 1.1 ounces (30 grams), or less than one-half the amount of propellant allowed for model rockets. With respect to the design of the model cars, there are no equivalent requirements for rocket propelled vehicles under the FHSA.

In support of the petition, Centuri provided staff with "Rocket Car Research, Final Report on Qualitative Study" (September 2000, Dr. Barbara Rugen). This study provided market and human factors information that indicated the potential popularity and potential use of model rocket cars. Centuri also submitted the results of independent testing conducted by Specialized Technology Resources Inc (April, 2001). These tests involved the prototypes' mechanical safety, the adequacy of labels, flammability, and performance evaluations.

THE PRODUCTS

The Directorate for Economic Analysis developed some product information regarding model rocket motors and the prototype model rocket cars. (TAB C)

Model Rocket Motors

A model rocket motor consists of a fuel and an oxidizer. The most common motors are black powder (sulphur, charcoal, and a nitrate) compressed into a cardboard tube. They are available in sizes "1/4 A" through "O", each size having twice the total impulse power of the preceding size.

A wire igniter is inserted into the rear of the motor, and held in place with a plug. The igniter is energized by electrical current from a battery pack (4 "AA" sized batteries), causing ignition. Thrust is caused by this ignition, leading to the propulsion of the intended vehicle.

According to industry sources, about 5 million model rocket motors are sold annually, in sizes up to and including "D" --- the sizes for which the exemption would apply. Size "A" motors typically retail for about $1 each, while size "D" motors typically retail for about $2.50 each.

Two firms, Centuri (of Penrose, CO) and Quest Toy Biz (of Phoenix, AZ), account for virtually all U.S. sales of model rocket motors in these sizes. Some 95% of motors in these sizes are used in model rocketry. The remainder is used in model airplanes and gliders, and in scientific applications.

Model Rocket Cars

The petitioner has developed two prototype model rocket cars. The smaller car, named "Blurzz," is shaped like a "rail," a type of custom-made vehicle used in competitive drag racing. The larger prototype, named "Screamin' Eagle," is shaped like a "Bonneville Speed Record" custom vehicle. Both are designed to be used with a nylon tether, which passes through the undercarriage of the prototypes and is also affixed to the rocket motor holder; the tether line is intended to be secured at both ends with weighted stops. The rocket motor is inserted into the holder at the rear of the car, and is activated through an "igniter" which is energized by 4 AA batteries in a separate control mechanism.

The petitioner has indicated that the smaller Blurzz car (using an "A" motor) would retail for about $25, and would be sold through mass marketers. The large Screamin' Eagle car (using a "D" motor, about 8 times as powerful as an "A" motor) would retail for about $40, and would be sold exclusively through hobby shops.

Other Propelled Model Cars

Pellet-powered model cars (allowed under an exemption to the FHSA) were popular in the 1950s, but have since declined in popularity. The pellet is composed of up to 11.5 grams of black powder. This amount of propellent compares to about 4 grams in an "A" motor, and 25 grams in a "D" motor. Industry sources estimate that about 100,000 pellet-powered model cars are sold in the U.S. annually. One firm, Jetex (of the United Kingdom) accounts for virtually all sales of pellet-powered model cars.

There are some other types of propelled model cars currently offered for sale, including models powered by water, forced air, and chemical reaction (the mixture of vinegar and baking soda results in a release of gas). None of these alternatively-powered model cars can attain the speeds reported for the prototype rocket-powered units.

While not commercially available, model cars propelled by model rocket motors have been used by hobbyists and do-it-yourselfers at least since the 1970s, as shown in articles in hobbyist magazines and on Internet web sites. The articles refer to "custom" model rocket cars, and describe the models as "collector's quality."

Other specialty rocket-powered model cars are being used in the US. These are larger cars (weighing upwards of 100 pounds), which use much higher-powered rocket motors ("G" motors and larger). These high-power cars may use remote controls for steering or may be unguided, and are commonly run in large, flat areas (such as the Bonneville Salt Flats). One group, the National Model Rocket Car Association, conducts tests and competitions involving these cars. The extent of such use is not known. Sales and use of these specialty rocket cars are confined to professionals and serious enthusiasts.

Epidemiological Information

The Directorate for Epidemiology (EPI) conducted a data search through the National Electronic Injury Surveillance System (NEISS) for injuries associated with model rocket motors

and model rocket cars. Since model rocket cars have not been commercially available, no injury cases specific to model rocket cars were uncovered. However, cases involving model rockets and rocket motors were reported. Based on the NEISS data, an estimated 1,100 emergency room-treated injuries occurred over the period January 1997 through 2000 (or about 275 per year) involving model rockets and model rocket motors. About 86% of these injuries were to children under the age of 15. Nearly all of the injuries were to males. (TAB D)

Other CPSC databases were searched for the period 1980 to mid-year 2001. The result does not provide a statistical sample, but does provide anecdotal information on the types of injuries reported. Of the 35 reported non-fatal injuries for the 20-year period, most appeared to involve the currently-exempted rocket motors. These motors were either installed in rockets or were ignited separately. Additionally, some injuries referred to homemade rocket motors (or propellant taken from motors) and homemade rockets. EPI noted that the rocket motors used in model rocketry and those to be used in model rocket cars are identical. It is reasonable to assume that any increase in the availability of these motors as a result of use in model rocket cars would lead to additional rocket motor injuries.

Several of the 35 nonfatal cases noted above also involved mechanical hazards associated with products that travel on a horizontal path, as would be similar to the path of a model rocket car. In some cases, victims were struck by products powered by rocket motors or by an improperly mounted (or unmounted) rocket motor. Additionally, staff is aware of two reported deaths that involved victims being struck by powered model airplanes. These incidents may be relevant since the use of rocket motors in model cars would also involve a horizontal path, rather than – if used in model rockets – a vertical path. Tests conducted by Specialized Technology Resources (for the petitioner) confirmed that the model cars can become airborne.

Informal Firings and Engineering Issues

The Directorate for Engineering Sciences (ES) reviewed available literature and supervised two series of firings of the prototype model rocket cars, conducted at the

Commission's Engineering Lab. These included test runs as directed by the manufacturer, as well as foreseeable misuse. (TAB E)

ES reported that, in all of the test firings where the manufacturer's instructions were followed, the cars operated along the tether line; this line provides directional control, analogous to the launch pad and guide wire used in model rocketry. ES concluded that the tethering system defines the direction of travel of the vehicle, and provides a significant increase in the performance characteristic of the model car.

ES noted that, during one of the informal staff firings, the larger "Screamin' Eagle" prototype became airborne, reaching a height of about 4 feet while remaining tethered. The potential for contact thus would involve someone standing near or straddling the tether line.

ES also pointed out that pellet-powered model cars are exempted from the FHSA, provided that the pellet contain 11.5 grams or less of black powder; size "A" rocket motors contain 4 grams of black powder. However, because the pellets provide thrust for as much as 12 seconds (compared to ½ second for "A" motors), the velocity that pellet-powered cars can attain is substantially lower than that attained by model rocket cars powered by "A" motors.

Potential Injury Scenarios and Extent of Injuries

After review of the informal firings at the CPSC's Engineering Laboratory and analysis of available data on the impact potential of the model rocket cars, the Directorate for Health Sciences (HS) discussed the types of injuries that could occur with model rocket cars in the configuration provided by the petitioner. Based on the size of the model and the rocket motor, the kinetic energy and trajectory of the vehicle, and the part of the body that may be struck by the vehicle, HS concluded that collision with one of these vehicles has the potential to produce bruises, abrasions, and lacerations. Additionally, collision with the model rocket car also could result in "ocular or other facial trauma, and fractures." Of specific concern is contact with the eye, which could cause blindness. Contact could also result in fractures of small bones around the eyes, nose and mouth fractures, and other fractures of small bones, such as in the hands and

feet. HS also noted that contact with a rocket motor while still firing could lead to severe, and possibly fatal, burns. (TAB F)

Human Factors Analysis

The Human Factors Division (HF) gathered available data on the likelihood that the model rocket cars would be purchased and used by children and the likelihood that a child would operate the car without a tether. HF also reviewed the adequacy of the instructions and labeling, and whether a child would be likely to read and heed the labeling. (TAB G)

Based on the characteristics of the product, labels on the rocket motors and characteristics of children, HF concluded that the larger prototype car (powered by the "D" motor) would likely be purchased for and used by children ages 12 and older. The smaller car (powered by an "A" motor) is likely to be purchased for and used by children ages 10 and older.

HF noted that, because the model rocket cars would be fired repeatedly and travel on the same course, the model rocket car may lose its excitement to users. In support of this conclusion, a marketing study conducted for Centuri noted the likelihood that some of the users would experiment and use the car without the tether line. Further, according to the marketing study, children may use the cars with a ramp, or with different line tensions for the sake of novelty; such use would have an effect similar to use without the tether line.

HF also noted that, for both vehicles, the reading ability required to understand the product instructions is the fifth grade level (age 10-11). However, while children of this age group may be capable of reading the instructions, there are too many visuals on the instructions page for the larger model, and the instructions for the smaller model are not precise enough for a user of this age. This complexity makes it difficult for children to follow the instructions. Moreover, HF noted that the warning labels in the assembly instructions for the model rocket cars "are buried and may not attract attention," and that "the comparatively inconspicuous warnings in the assembly instructions may have little or no influence on children." Thus, the

warnings "may not attract a child's attention and are, therefore, likely to have weak impact on children's behavior."

SUMMARY

Model rocket motors of certain sizes are already exempt from the FHSA, for use with model rockets. The petition requests that the Commission also exempt their use in certain model rocket cars. The main difference in these uses is that, while model rockets are launched in a vertical direction, rocket cars would be launched in a horizontal direction; this increases the potential for striking bystanders and could result in injury. Further, HF information indicates that the model rocket cars sometimes will be used without the tether attached; this could result in an unguided flight of the products, and increase the potential for collision injuries.

Options

1. Grant the Petition

   If, after consideration of the available information, the Commission finds that an exemption for use of these motors with model rocket cars is appropriate, the Commission could grant the petition and direct the staff to develop a proposed rule exempting rocket motors for these model rocket cars.

2. Deny the Petition

   If the Commission finds that the petitioner did not present sufficient information to reasonably conclude it should begin a rulemaking to exempt rocket motors for use in model rocket cars, the Commission could deny the petition.

RECOMMENDATION

Staff recommends that this petition be denied. The petitioner has not provided sufficient information from which to conclude that the use of model rocket propellant devices in model rocket cars would be a safe application.

Epidemiological data show that there have been injuries associated with rocket motors intended for use in model rocketry; the bulk of these injuries have been the apparent result of foreseeable misuse of the motors. If the Commission were to exempt model rocket cars (and there were increased sales of motors because of this use), staff would expect an increase in these motor-related injuries. Moreover, since model rocket cars travel on a horizontal path, these products would pose the additional risk of physical impact of the vehicles with users and bystanders. Staff is aware of two deaths associated with the physical impact of model airplanes, which also operate on a horizontal path.

In addition to bruises, abrasions, and lacerations, collision injuries involving model rocket cars could include facial fractures, with the potential for blindness, and fractures to the hands and feet. Because the model rocket cars operate horizontally, it is also possible that bystanders could come in contact with the motors while they are still firing; this contact could result in severe burns and, possibly, death.

Human Factors information noted the likelihood that users will fire the model rocket car without the restricting tether line attached, and that users will also operate the products in other, potentially unsafe ways. Further, the product's warning labels and assembly instructions may have little impact on young users' safe operation of these model rocket cars.

A

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2001 JAN 26 P 3:10

January 23, 2001

Via US Mail

Office of the Secretary
US Consumer Product Safety Commission
Washington, DC 20207

Petition for an Exemption from Banned Hazardous Substances List
(Revised resubmission of November 29, 2000)

Dear Madam/Sir:

This is a petition to initiate Commission rulemaking pursuant to 16CFR §1500.2 Authority and is in accordance with 15USC§1261(q)(1). It is a petition to initiate Commission rulemaking to exempt model rocket propellant devices as described in 16 CFR §1500.85(a)(8) so that they may be used to propel model rocket vehicles.

An exemption is necessary because the current exemption in 16 CFR § 1500.85(a)(8) for model rocket propellant devices only exempts those designed for use in light-weight, recoverable, and reflyable model rockets. Specifically, an exemption is requested to be added to 16 CFR § 1500.85(a) as follows:

(14) Model rocket propellant devices (model rocket motors) to propel lightweight surface vehicles such as model rocket cars, provided such devices:

- Are designed to be ignited electrically from a minimum distance of 15 feet (4.6 m) away. *(This is consistent with the requirements developed and promulgated by the National Association of Rocketry in its Model Rocketry Safety Code for flyable model rockets.)*

- Contain no more than 1.1 ounces (30 g) of propellant material and produce no more than 4.48 pound-seconds (20 Newton-seconds) of total impulse with a thrust duration not less than 0.050 seconds. *(The 30-gram limit is consistent with U.S. Department of Transportation classification limits for Model rocket motors, NA 0323. See 49CFR §172.102(c)(1) Code/Special Provisions 51.)*

- Are constructed such that all the chemical ingredients are preloaded into a cylindrical paper or similarly constructed nonmetallic tube that will not fragment into sharp, hard pieces.

- Are designed so that they will not burst under normal conditions of use, are incapable of spontaneous ignition, and do not contain any type of explosive or pyrotechnic material other than a delay and small recovery system activation charge.

- Bear labeling and include instructions providing adequate warnings and instructions for safe use.

- Comply with the requirements of 16CFR §1500.83 (a)(36)(i-iii).

And for surface vehicles such model rocket cars and kits therefore, provided such devices:

- Are lightweight and constructed mainly of materials such as balsa wood or plastics that will not fragment into sharp, hard pieces.

- Are designed so that the engine mount is meant to be permanently attached by the manufacturer to a track or track line that will provide control of the vehicle's direction for the duration of its movement.

- Are not designed to carry any type of explosive or pyrotechnic material other than the model rocket motor(s) used for primary propulsion.

- Are designed to utilize a braking system such as a parachute or shock-absorbing stopping mechanism.

- Bear labeling and include instructions providing adequate warnings and instructions for safe use.

Following are explanations of the differences between flyable model rockets and model rocket surface vehicles and possible safety implications:

- **A flyable model rocket** is designed so that it is aerodynamically stable meaning that it will have a true and predictable flight pattern. It is designed to be guided into the air, first by a launching device, which controls its first few feet of flight, and then by fins or other aerodynamic device(s) which work to keep the flying model rocket on its set course.
  If it is unstable, its erratic flight takes place in the air, away from people.

- **A model rocket vehicle** is designed to travel along the surface of the earth. Its course is controlled for the duration of its movement via attachment to a motor mount attached to a track or tethered track line.
  Because it is attached to a track or tethered track line, its course cannot become erratic. Instructions and the Rocket Car Safety Code will direct people to maintain a specific distance from the track.

- **A flyable model rocket** is constructed with an integral mount for the model rocket propellant device.
  The mount is generally centered in the rocket to produce a centered force to carry the rocket upward.

- **A model rocket vehicle** is constructed without the mount. The mount for the model rocket propellant device is a permanent and integral part of the track. The vehicles, which are interchangeable, must be attached to the mount to run. *This assures that the vehicles can only be run on the track. The mount is angled to produce a slightly downward thrust to keep the vehicle on the surface and to prevent damage to the track or track line.*

- **Both flyable model rockets and model rocket surface vehicles are** propelled with model rocket propellant devices that are to be ignited electrically and remotely.
This protects people from the potential of injury due to ignition and any potential failure of the model rocket propellant device.

- The ejection charge of the model rocket propellant device is used to activate the recovery system of a flyable model rocket or a model rocket vehicle.
The recovery system provides for the slow descent of the rocket or activates the braking system of the rocket vehicle. A model rocket vehicle can be also be slowed and stopped by other means such as a drag-parachute or shock-absorbing stopping device attached to the track. These are activated by the forward and controlled course of the vehicle. Both flyable model rockets and model rocket vehicles are reusable.

Engineering drawings, specifications, bills of materials, product brochures, packaging compositions, instructions and the proposed Estes Rocket Car Safety Code as well as a video and a marketing study have already been provided. As recommended in 16CFR §1051.5(c)(5) five copies of the latest revisions of all materials previously provided are enclosed. In addition, we have obtained quotations from a testing laboratory for use/abuse testing of the proposed products and will provide five copies of the summary of the results as soon as available.

Please advise of additional information that may be required or should you have further questions. We will do our best to provide the materials or responses as quickly as possible. Thank you for your attention and consideration of our petition.

Sincerely,

Barry Tunick,
President
Centuri Corporation

Enclosures: 5 Sets

[redacted]

B

[redacted]

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: August 3, 2001

TO : Terrance R. Karels, Economic Analysis,
Project Manager, Petition HP 01-2
Directorate for Economic Analysis

THROUGH: Alan H. Schoem, Director, EXC
Carlos L. Perez, Associate Director, CRC
Michael Gidding, Attorney, CLD

FROM : Patrick Race, Compliance Officer, CRC, x-1451

SUBJECT : Centuri Corp, Petition HP 01-2

Background: Centuri Corporation of Penrose, CO, manufactures model rocket motors. Because these motors generate pressure by decomposition, heat, or other means and are used in articles that are intended for use by children, the motors are technically banned hazardous substances under section 2(q)(1)(A) of the Federal Hazardous Substances Act. However, at the request of the model rocket industry (including Estes Company, a predecessor of Centuri Corp.) the Commission's predecessor, the Food and Drug Administration, promulgated a limited exemption for these items, as long as they are labeled with adequate instructions and warnings for safe use. The existing exemption for model rocket motors, 16 C.F.R. §1500.85(a)(8), covers motors for use in "light-weight, recoverable, and reflyable model rockets," and is intended to allow relatively low power engines[1] to be used in model rockets designed to fly vertically into the air. There is also an exemption for solid fuel pellets intended for use in miniature jet engines for propelling model jet airplanes, speed boats, racing cars and similar models at 16 C.F.R. §1500.85(a)(10).

In October of 2000, Centuri contacted the Office of Compliance regarding products the company was developing that used class "A" and "D" rocket motors in model cars designed to travel along the ground.[2] The use of these classes of engines in products of this nature does not fall within either of the exemptions at 16 C.F.R. §1500.85. As part of its request that it be allowed to market the product under the existing exemption, Centuri presented its design concept to Compliance and technical staff on November 7th, 2000.

[1] The exemption limits the size and performance of these engines to 62.5 grams of propellant material that produce less than 80 newton-seconds of total impulse with a thrust duration not less than 0.050 seconds. Motors larger than the limits in 16 C.F.R. §1500.85(a)(8) are considered regulated explosive materials by the Bureau of Alcohol, Tobacco and Firearms (ATF) and the manufacture, distribution and sale, and under some circumstances, possession of the larger size motors are subject to ATF regulation and requirements.

[2] Model rocket motors are classified using a letter system that assigns a class based on the motor's total propellant weight and its performance. Class "A" is generally the least powerful and smallest engine. The size and power of the engines increase as the letter changes, e.g., class "H" is more powerful that class "D."

The firm made mock-ups of the two products available to the staff. A larger model, tentatively called the "Screaming Eagle" uses the "D" class engine. Centuri proposes to market this product to older consumers, primarily adults. The smaller vehicle is tentatively called "Blurz" and incorporates an "A" class engine; the firm intends recommended use to be for ages 12 and up. The firm also provided a videotape and drawings of the product. Centuri presented very limited marketing and human factors information and only prototype labeling and packaging concepts. The staff expressed concern regarding a number of issues, including the vehicle engine mount's lack of a permanent attachment to the tether line that guides the car (see attached draft advertisement). In addition, the staff had concerns about the general safety of this design concept and other designs along similar lines that might be offered to consumers.

The Compliance staff determined that it should not exercise enforcement discretion to allow the product to be sold. The products are not model rockets meant to be "re-flyable" nor do the current designs meet the existing exemption for fuel pellets used in rocket motor powered cars. Moreover, we did not believe that the information that Centuri presented was sufficient to allow us to conclude that the risks the model cars might present were similar enough to those presented by the exempt rocket engines to allow us to treat the cars as falling within the intent of the exemption. We therefore notified Centuri of our decision (letter attached) and forwarded its request and supporting materials to the Office of General Counsel (OGC) for consideration as a possible petition.

Centuri submitted additional materials and correspondence requesting that the Commission issue a rule exempting from the definition of "banned hazardous substances" certain model rocket propellant devices to be used for model rocket ground vehicles. OGC docketed the request as a petition (OGC Memorandum dated February 14, 2001 attached) and the Commission voted to issue a Federal Register notice requesting public comments. The comment period closed on May 7, 2001.

Since the staff received Centuri's petition, the firm renewed its request that it be allowed to market these products, pending a decision on the merits of its petition. Even though the firm has not yet distributed the products in the U.S., it has already placed orders for them. Century has also submitted additional materials. These materials include a marketing survey involving children as young as 8 years of age and a product redesign that included a tether/guide line attached to the engine mount of the vehicles(s). In April, the company met with compliance and technical staff and demonstrated prototypes of the two vehicles. The staff still has concerns and questions based on its preliminary review of Centuri's materials and field tests of the model cars. For example the cars travel horizontally along the ground at a high rate of speed (up to 80-90 mph for the larger design) and require approximately 100 to 500 feet of smooth, level concrete or blacktop for safe operation as designed. The availability of large stretches of appropriate hard surfaces may be extremely limited. Further, the cars can be operated off of the "tether" or guide line and therefore be pointed at anyone or anything and launched. It may also be possible to use rocket motor engines of bigger and more powerful classes than are specified for these vehicles with little or no modification to the engine mount. Therefore, on May 18, 2001, for the reasons stated above, the Office of Compliance again declined to exercise enforcement discretion to allow the products to be sold.

Centrui asked that the Commission consider its request for a stay of enforcement on May 22, 2001. On August 1, 2001 the Commission unanimously rejected Centuri's request for a stay of enforcement pending a recommendation by EXHR staff on the technical merits of the petition.

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: September 7, 2001

TO : Warren J. Prunella, Associate Executive Director
For Economic Analysis

FROM : Terrance R. Karels, Economic Analysis TRK

SUBJECT : Model Rocket Cars --- Petition HP-01-2

This memorandum, in response to a petition submitted by Centuri Corporation (January 23, 2001), provides some background information on the market for rocket powered model cars. The rocket propellant devices (also called motors or engines) are banned hazardous substances under the Federal Hazardous Substances Act (FHSA), except in certain exempted applications. The petition seeks to exempt from the definition of "banned hazardous substances" rocket motors to be used to propel model cars.

Model Rocket Propellant Devices

A model rocket motor consists of a fuel and an oxidizer. The most common motors consist of a cardboard tube in which black powder (sulphur, charcoal, and a nitrate) is compressed into a solid mass. They are available in 17 sizes ranging from "1/4 A" to "O", each size having twice the power of the preceding size. Wire igniters are inserted into the rear of the motor, which are energized by electrical current from a battery pack, causing ignition. Thrust is caused by this ignition, leading to propulsion of the vehicle.

The petitioner requests an exemption for motors through size "D" for use in model cars. According to industry sources, about 5 million motors, in sizes "¼ A" though "D", are sold

annually for all exempted uses. These sizes refer to the amount of black powder propellant in each motor. Two firms, Centuri (of Penrose, CO) and Quest Toy Biz (of Phoenix, AZ), reportedly account for virtually all US sales of rocket motors in those sizes. Centuri (also known as Estes Industries) markets a wide variety of reflyable model aircraft and accessories in addition to rocket motors.

An estimated 95% of total annual sales of motors in the "A" to "D" size range are used in model rockets, which are exempted from the ban. The remainder is used in some model airplanes and gliders, and other uses; one common use is in academia, such as for "time-thrust studies." Size "A" motors typically retail for about $1 each, while size "D" motors retail for about $2.50 each.

According to industry guidelines, rocket motors in sizes "D" and lower are intended for use by consumers aged 10 and up. The guidelines specify adult supervision for users under age 12. In California, state law requires that purchasers of motors up to size "D" must be at least 14 years old; New Jersey requires purchasers of motors up to size "C" to be at least 14, and both states require purchasers of larger motors to be at least 18.

Canada restricts sales of rocket motors in sizes "D" to purchasers over the age of 12, while the UK restricts these sales to those over 18. France prohibits the sale of motors in these sizes to minors (age not specified). Germany restricts sales of "A" motors to those over 18, and "D" motors to those over 21.

Model Rocket Cars

The petitioner has developed two prototype model rocket cars. The smaller prototype, using a size "A" motor, is shaped like a "rail," used in competitive drag racing. The larger prototype, powered by a size "D" motor (some 8 times as powerful as an "A" motor), is shaped like a "Bonneville Land Speed Record" racing car. Both models are scaled at about 20:1 (about 1/20 the size of the actual cars, based on an analysis of design speeds). Each of the cars is

designed to have the motor inserted into a holder, which is then inserted into the rear of the car. The holder is, in turn, secured to a nylon tether or guideline. The tether line is 150 feet long for the smaller car, and 600 feet long for the larger unit.

The petitioner has indicated that the expected retail price for the smaller model rocket car (using an "A" motor) would be about $25 each, while the expected retail price of the larger model (using a "D" motor) would be $40 each. The anticipated marketing and distribution channel for the larger model would be exclusively to hobby shops, while the smaller models would be sold though mass marketers.

The FHSA currently exempts solid-fuel pellets for use in model cars. The exemption applies to pellets of not more than 11.5 grams each (by comparison, size "A" rocket engines are 7 grams, and "D" engines are 44 grams). Pellet-powered cars were introduced in the 1950s. Currently, US sales are estimated at about 100,000 annually. One firm, Jetex (of the United Kingdom), reportedly accounts for all sales of these pellet-powered cars.

Because of the restrictions of the FHSA, there is no known commercial manufacture of model cars designed to use rockets motors. However, there is evidence of limited production of model cars that have been constructed by the intended users (e.g., hobbyists), and adapted to use rocket motors. These cars have been in use at least since the 1970s, according to references found on the Internet and industry sources. Also, industry sources state that rocket-powered model cars similar to the prototypes submitted by the petitioner have seen widespread use in Great Britain and other countries.

Also, the staff is aware of four domestic manufacturers of "specialty cars" using "High Power" rocket motors (sizes G and higher) which are not available to children. These firms produce custom-built cars, in some cases weighing in excess of 100 pounds, with features such as remote control steering. Thus, these cars are not similar to those for which Centuri has sought an exemption.

User Groups

Two organizations provide advice and guidance to rocket hobbyists. The National Association of Rocketry (NAR) (Altoona, WI) is the largest hobbyist rocket organization. A spokesman for NAR stated that the organization has not written proposed guidelines for casual use of rocket motors in model cars because of the FHSA ban, and anticipated low acceptance of the products if exempted. Tripoli (Orem, UT) represents the interests of "high-power" rocket users and has developed "Rocket Car Safety Rules." The National Rocket Car Association (Las Vegas, NV) is noted on the Internet as a group for hobbyists of "high-power" model rocket car racing.

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: July 25, 2001

TO : Terrance R. Karels, Project Manager
Directorate for Economic Analysis

THROUGH: Sue Ahmed, Ph.D.
Associate Executive Director, Directorate for Epidemiology

Russ Roegner, Ph.D.
Division Director, Division of Hazard Analysis

FROM : Robin Ingle, Mathematical Statistician
Division of Hazard Analysis

SUBJECT : Model Rocket Powered Car Petition

This memorandum was prepared in response to Petition HP 01-2, which requests an exemption from the Federal Hazardous Substances Act for the marketing of model rocket powered cars.

Injury Estimates

Data from the National Electronic Injury Surveillance System (NEISS) were searched for injuries associated with the product. Since model rocket powered cars have not been on the market, no injury cases have been reported through NEISS. Model rocket powered cars use engines identical to those in model rockets themselves. An estimated 1,100 injuries associated with model rockets occurred between January 1997 and December 2000.[1] A large proportion (86 percent) of these injuries were to children under 15 years of age. Nearly all of the injuries occurred to males.

Reported Incidents

In addition to NEISS, other CPSC databases (IPII, INDP, DTHS) were searched in order to obtain only those incidents containing the words "rocket", "plane" or "car" in several product codes for

[1] The coefficient of variation for this estimate is 0.26.

powered models.[2] The resulting incidents do not constitute a statistical sample and therefore can not be used to produce estimates of injuries. However, they do provide anecdotal data that can be used to gain an understanding of some of the types of injuries that are occurring. Staff read the summaries of these incidents and further winnowed the data to only those incidents of interest.

With the exception of one homemade car, no incidents have been reported specifically involving model rocket powered cars because such products have not been marketed. The CPSC databases have no product code for such a product. However, staff searched the databases for incidents associated with products with similar characteristics. Model rocket incidents in which the hazard could be linked to the engine were included because the engines used for model rocket powered cars are identical. Some powered model airplane incidents involving mechanical hazards were included because both powered model airplanes and model rocket powered cars are projectiles that travel in a horizontal trajectory. These mechanical hazards include cases in which the injured person was struck or impaled by the product or a part of it.

Staff omitted incidents that did not appear to relate to hazards similar to those that could be produced by model rocket powered cars. For example, we found several fatal incidents in which the victim was electrocuted while retrieving a model rocket from a power line. Because staff determined (through CPSC testing) that the maximum height achieved by an airborne model rocket powered car was considerably less than power-line height, such incidents are not relevant to the discussion.

Deaths

In 1982, a 40-year-old male died of internal hemorrhage and trauma to the liver when a model airplane flew into his chest. In addition, in 1993, a 44-year-old male died after being struck in the head by a flying model airplane.

Injuries

In addition to the two deaths noted above, CPSC is aware of 35 injury incidents involving products similar to model rocket powered cars. Approximately 57% of the incidents involved fires, burns or explosions. Table 1 below gives a distribution of the hazard types from these incidents:

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[2] The table below details the criteria used to identify reported incidents in the CPSC databases that relate to model rocket powered cars.

Base Criteria for Selection of Incidents

Databases	Dates	Product Codes and Descriptions
Injury and Potential Injury Incident File (IPII) In-Depth Investigation File (INDP) Death Certificate File (DTHS)	January 1, 1980 to May 26, 2001	1306 *Gas or other fuel-powered models* 1314 *Rocketry sets* 1356 *Engine fuels for models* 5004 *Toys, not elsewhere classified*

Table 1: Hazard Patterns in Non-Fatal Injury Incident Data

Hazard Pattern	Number of Incidents
Struck by/impalement	3
Fires, burns and explosions	19
Other	3
Identifiable misuse	10
Total	35

More than half of the non-fatal injury incidents involved children under 17 years of age. Table 2 gives an age distribution of the injury incidents.

Table 2: Ages of Injured Persons in Non-Fatal Injury Incident Data

Age range	Number of Incidents
0 to 11 years	8
12 to 17 years	15
18 years and older	1
Unknown age	11

Listings of the 35 documents are attached, along with summaries from the available documents providing evidence for classification in the various categories.

Conclusions

Although we have no data on the specific product in question, we believe the incidents described offer sufficient evidence for concern. The hazards associated with model rockets and powered model airplanes are similar to those that may be experienced with model rocket powered cars. Because the engines are identical to model rocket engines, fires, burns and explosions can be expected with the marketing of model rocket powered cars. Because the model rocket powered cars were shown to have an airborne capability in CPSC testing, they may exhibit the same hazards as those in the deaths and injuries associated with powered model airplanes.

Deaths

Document Number	Summary
9304027374	STRUCK BY FLYING MODEL AIRPLANE - BLUNT FORCE INJURIES OF HEAD - AUTOPSY NO
820707HIA1270	ON JULY 4, 1982, A 40-YEAR OLD MALE WAS KILLED WHEN HE WAS STRUCK IN THE CHEST BY A GAS POWERED MODEL AIRPLANE OVER WHICH THE PILOT HAD LOST CONTROL.

Non Fatal Injury Incidents (Struck by/Impalement)

Document or Tracking Number	Summary
P9721509A	67574 STRUCK BY A MODEL PLANE E917.9 INJURY MECH: STRUCK BY OBJECT LEVEL OF CONSC: AWAKE 871.10 OPEN WOUND OF EYEBALL
X8795074A	A MAN WAS STRUCK IN THE EYE BY A PROPELLER THAT SPUN-OFF A MODEL AIRPLANE.
C8170194A	PIECE OF PLASTIC PROPELLOR ON TOY AIRPLANE STRUCK VICTIM IN EYE WHILE IN USE

Non Fatal Injury Incidents (Fires/Burns/Explosions)

Document Number	Summary
D8480097A	POCKET UNIT EXPLODED IN VICTIMS HAND WHILE HE WAS PLACING FIRING *DETONATOR PIN IN THE MOTOR. NO WARNING OF EXPLOSION OR ADULT* SUPERVISION
C9045038A	9-1/2 YEAR OLD BOY WAS INJURED WHEN A BATTERY OPERATED FAN APPARENTLY IGNITED A ROCKET HE WAS HOLDING IN HIS OTHER HAND.
C92C0001A	A 10 YEAR OLD MALE WAS INJURED WHEN A TOY ROCKET SET EXPLODED.
840822DAL5093	A TOY ROCKET ENGINE EXPLODED IN THE HAND OF A 12 YEAR OLD MALE WHEN THE TERMINALS OF A SMALL 9 VOLT BATTERY CAME IN CONTACT WITH THE IGNITOR LEADS ON THE ENGINE. THE VICTIM SUFFERED INJURIES TO HIS LEFT HAND, WAS HOSPITALIZED AND UNDERWENT SURGERY.
970310CMC8019	A 12 YEAR OLD MALE ASSEMBLED A MODEL ROCKET USING THE RECOMMENDED ENGINE. THE VICTIM PLACED THE ROCKET ON THE FLOOR IN HIS BEDROOM AND RETURNED TO HIS SCHOOL STUDIES. THE VICTIM HEARD A NOISE EMITTING FROM THE ROCKET. AS HE APPROACHED THE ROCKET, IT EXPLODED, SENDING DEBRIS INTO THE VICTIM'S BODY. THE VICTIM SUSTAINED 1ST AND 2ND DEGREE BURNS TO HIS UPPER BODY.
F8581025B	JUVENILES PLAYING WITH MODEL ROCKET APPARENTEY CAUSED GRASS FIRE.
F9070132A	GRASS FIRE WAS CAUSED BY A BOY PLAYING WITH A MODEL ROCKET.
F9255024A	A MALE WAS INJURED WHEN A MODEL ROCKET ENGINE EXPLODED.
G81A0003A	PRODUCT IS BELIEVED TO HAVE TOUCHED OFF THE FIRE.
G8710039A	TWO BOYS WERE ALLEGEDLY BURNED WHILE PLAYING WITH MODEL ROCKET ENGINES.
H88C0003A	AN 11-YEAR OLD BOY WAS HOSPITALIZED AFTER A BATTERY OPERATED MODEL ROCKET CAUGHT FIRE ON THE BOTTOM.
X9741169A	A 12-YEAR OLD MALE WAS HOSPITALIZED WITH 2ND- AND 3RD-DEGREE BURNS OVER 60% OF HIS BODY WHEN A MODEL ROCKET HE WAS WORKING ON IN HIS HOME IGNITED, SETTING HIS CLOTHES ON FIRE.
H8940174A	13 YEAR OLD BOY WAS INJURED WHEN TOY ROCKET EXPLODED IN HIS HAND.
F8291801A	BOY PLAYING WITH A TOY ROCKET CAUSED A SMALL GRASS FIRE.
840814BEP0003	VICTIM, 13 YEAR OLD MALE SUFFERED A THERMAL BURN TO (R) HAND, WHEN FLAMES FLARED UP FROM A ROCKET SCHOOL PROJECT. VICTIM AND FRIENDS WERE EXPERIMENTING W/WOODEN ROCKET INCLUDING CHEMICALS AND POWDERS IN THE YARD AT HOME. WITHOUT NOTICING, VICTIM'S LITTLE BROTHER TOOK A MATCH AND LIT THE CHEMICALS AND POWDER CAUSING FLAMES TO FLARE UP. THE FLAMES CONTACTED VICTIM'S HAND. RESPONDANT STATES SHE DESTROYED THE ENTIRE PROJECT SINCE VICTIM'S INJURY. VICTIM WAS PREPARING PROJECT FOR HIS INDUSTRIAL ART CLASS AT SCHOOL. THE MOTHER WAS NOT AN EYE-WITNESS TO ACCIDENT.
940705HEP6081	THE 13 YEAR OLD MALE VICTIM SUSTAINED 2ND & 3RD DEGREE BURNS TO HIS RIGHT HAND WHEN A MODEL ROCKET EXPLODED IN IT. IT WENT OFF WITHOUT HAVE BEEN IGNITED. HE WAS TAKEN TO THE EMERGENCY ROOM, TREATED AND RELEASED.
H8630525A	MODEL ROCKET EXPLODED UNDER NORMAL USE.

Non Fatal Injury Incidents (Fires/Burns/Explosions)

Document Number	Summary
C9895015A	THE MALE VICTIM, AN INFANT, WAS INJURED WHEN A MODEL ROCKET ENGINE CAUGHT FIRE IN HIS POCKET.
F9145015A	18 YEAR OLD MALE SUFFERED A SERIOUS HAND INJURY WHEN A MODEL ROCKET ENGINE OR OTHER EXPLOSIVE DEVICE HE WAS BUILDING EXPLODED.

Non Fatal Injury Incidents (Other)

Document Number	Summary
C97C0023A	THE VICTIM WAS INJURED FROM A TOY ROCKET.
C9995002A	A CHILD WAS INJURED USING A MODEL ROCKET ENGINE IGNITOR PLUG.
940630HEP5283	THE 7 YEAR OLD FEMALE VICTIM SUSTAINED AN ABRASION ON HER CHEST WHEN HER FATHER ACCIDENTALLY FELL ON TOP OF HER WHILE TRYING TO GET OUT OF THE WAY OF A FALLING MODEL ROCKET. SHE WAS TAKEN TO THE HOSPITAL, TREATED AND RELEASED.

Non Fatal Injury Incidents (Misuse)

Document Number	Summary
N9330002A	A 13 YEAR OLD MALE WAS INJURED WHEN A MODEL ROCKET EXPLODED. HE TOOK THE ENGINE APART AND IGNITED THE PROPELLANT WITH A MATCH. FIRST DEGREE FACIAL BURNS.
N8710162A	BOY, 11, WAS HOSPITALIZED FOR BURNS RESULTING FROM EXPLOSION OF MODEL ROCKET MOTOR HE IGNITED WITH A MATCH.
G9240297A	A 12 YEAR OLD MALE WAS SEVERELY BURNED AFTER IGNITING A ROCKET PROPELLANT THAT IGNITED HIS COAT. MOTOR WAS IGNITED WITH A 6-VOLT BATTERY. AT FIRST, THE MOTOR DID NOT IGNITE, AND THE VICTIM BENT DOWN TO EXAMINE IT. IT THEN IGNITED AND FLEW INTO HIS COAT, WHERE IT WAS TRAPPED.
N9330001A	A 12 YEAR OLD MALE WAS INJURED WHEN A MODEL ROCKET EXPLODED. HE DISMANTLED THE MOTOR, EXTRACTED THE POWDER AND IGNITED IT TO FIND OUT WHAT WOULD HAPPEN. FLASH BURNS TO LEG.
920518CWE5024	A 10 YEAR OLD MALE CUT OPEN A MODEL ROCKET ENGINE (TOY ROCKET PROPELLANT) CONTAINING BLACK POWDER. HE THEN POURED THE POWDER INTO A METAL CAN AND STRUCK A MATCH. A FLASH OCCURRED WHEN THE POWDER IGNITED. HE RECEIVED 1ST AND 2ND DEGREE BURNS TO HIS HANDS AND FACE. HE STAYED IN THE HOSPITAL FOR 4 DAYS. THE INCIDENT OCCURRED IN HIS BACKYARD.
911114CCC1097	A 12 YEAR OLD MALE SUSTAINED SECOND AND THIRD DEGREE BURNS OVER 40 TO 50% OF HIS BODY WHEN HE AND A FRIEND WERE ATTEMPTING TO IGNITE A ROCKET MOTOR SITTING ON A PLAYGROUND FENCE BY POURING GASOLINE UPON IT AND THEN IGNITING THE GASOLINE WITH A MATCH. THE VICTIM HELD THE MATCH IN ONE HAND AND A CUP OF GASOLINE IN THE OTHER HAND AS HE WAS POURING IT. THE MATCH BURNED DOWN BURNING THE VICTIM'S FINGERS AND HE SUBSEQUENTLY SPILLED GASOLINE UPON HIM WHICH IGNITED. HE WAS HOSPITALIZED FOR OVER ONE MONTH.
930625CEP9005	THE RESPONDENT, WHO IS THE FATHER OF THE VICTIM, STATED HIS FIFTEEN YEAR OLD SON SUSTAINED A FRACTURE AND LACERATION TO HIS NOSE WHEN HE WAS STUCK BY AN UNMOUNTED ROCKET "MOTOR" WHICH HE LAUNCHED IMPROPERLY.
N9190170A	AN 11 YEAR OLD MALE WAS BURNED TRYING TO IGNITE A MODEL ROCKET USING GASOLINE WHEN A RAG IGNITED AND HIS SHIRT AND PANTS WERE IGNITED.
H8140094A	VICTIM DISASSEMBLED TOY ROCKET ENGINE, EMPTIED OUT POWDER, PUT IT ASPIRIN BOTTLE, IGNITED IT WAS SEVERELY BURNED BY RESULTING EXPLOSION.
821007BEP0007	VICTIM APPARENTLY FOUND ON OLD ROCKET ENGINE IN HIS ROOM. HIS PARENTS INDICATE THAT HE MISUSED THE PRODUCT. HOBBY ROCKET ENGINES HAVE SOLID FUEL PROPELLANT SYSTEMS THAT ARE PLACED IN MODEL ROCKETS AND IGNITED USING A LONG ELECTRCAL WIRE. VICTIM PLACED THIS ROCKET ENGINE IN A CONTAINER AND TRIED TO LIGHT IT WITH A MATCH. IT EXPLODED.

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: September 7, 2001

TO : Terrance R. Karels, Economic Analysis,
Project Manager, Petition HP 01-2
Directorate for Economic Analysis

THROUGH: Hugh McLaurin, Associate Executive Director
Directorate for Engineering Sciences
Nicholas V. Marchica, Division Director
Division of Mechanical Engineering

FROM : Troy W. Whitfield, Mechanical Engineer
Directorate for Engineering Sciences

SUBJECT : Petition HP 01-02 --- Rocket Powered Model Cars

This memorandum is in response to Petition HP 01-02 asking the Commission to grant an exemption from the Federal Hazardous Substances Act for model rocket propellant devices for use in model rocket cars. Centuri Corporation/Estes Industries, a maker of model rockets and propellant devices, located in Penrose, Colorado requested the exemption.

BACKGROUND

The Federal Hazardous Substances Act (FHSA) bans toys that contain hazardous substances that are accessible to children, unless specifically exempted by Commission authority. Model rocket propellant devices, also referred to as model rocket motors or engines, are included in this category. Model rocket engines for use in light-weight rockets are exempt from this ban, provided they are ignited by electrical means, contain no more than 62.5 grams (2.2 ounces) of propellant and, produce less than 80 Newton-seconds (17.92 pound-seconds) of total impulse with a thrust duration not less than 0.05 seconds. The FHSA regulations also exempt solid fuel pellets for model airplanes, speedboats, racing cars, and similar models, under similar conditions. These exemptions are found in 16 CFR, Section 1500.85(a)(8) and (10).

The petitioner is developing model cars that would use model rocket motors (rather than pellets) for propulsion. In October 2000, the petitioner met with the Commission's Compliance staff about the use of rocket motors with model cars and subsequently, in November 2000, met with staff to present its prototype designs. On January 23, 2001, Centuri Corporation petitioned the Commission requesting an exemption from the FHSA for rocket motors used in certain model cars.

THE PETITION

The petition seeks an exemption to propel lightweight surface vehicles such as model rocket cars, provided that the **rocket propellant devices**: [1]

- are designed to be ignited electrically from a minimum distance of 15 feet;
- contain no more than 1.1 ounces (or 30 grams) of propellant material, and produce no more than 4.48 pound-seconds of total impulse with a thrust duration of not less than .05 seconds;
- are constructed such that all chemical ingredients are preloaded into a cylindrical paper or similarly constructed nonmetallic tube that will not fragment into sharp, hard pieces;
- are designed so that they will not burst under normal conditions of use, are incapable of spontaneous ignition, and do not contain any type of explosive or pyrotechnic material other than a delay and small recovery system activation charge ;
- and bear labeling and include instructions providing adequate warnings and instructions for safe use.

And, provided that the **model rocket cars**:

- are lightweight and constructed mainly of materials such as balsa wood or plastics that will not fragment into sharp, hard pieces;
- are designed so that the engine mount is meant to be permanently attached by the manufacturer to a track or track line that will provide control of the vehicle's direction for the duration of its movement;
- are not designed to carry any type of explosive or pyrotechnic material other than the model rocket motor used for primary propulsion;
- are designed to use a braking system such as a parachute or shock-absorbing stopping mechanism;

[1] This provision is consistent with requirements developed by the National Association of Rocketry, for flyable model rockets. Attachment 1.

- and bear labeling and include instructions providing adequate warnings and instructions for safe use.

The proposal for the rocket car engines is consistent with the current requirements for the FHSA exemption[2] for rocket engines used in model rockets with two specific changes. First, a minimum length of 15 feet for the electrical ignition system is specified where no length is mentioned in the exemption for model rockets. Second, the amount of propellant material specified for model cars would be limited to 1.1 ounces (30 grams), or one-half the amount of propellant allowed for model rockets, and produce no more than 4.48 pound-seconds of total impulse (17.92 pound-seconds for model rockets). The petitioner's specifications for rocket propelled surface vehicles are similar to the FHSA requirements for rocket motor propelled devices - lightweight, recoverable and re-flyable (reusable).

THE PRODUCTS

Model Rocket Engines

Rocket engines are typically sold through toy stores and hobby shops for use in model rocketry and occasionally with other 'flying craft' such as model airplanes and gliders. Model rockets are also available through these types of stores and come in various sizes. Because of the different sizes and weights, engines are also available in different sizes to deliver various characteristics, such as impulse, time delay, and thrust.

The impulse is the amount of force created by the engine for a fixed amount of time. The time delay is the amount of time between the burning of all the propellant and the activation of the ejection charge. The delay allows the rocket to coast to a peak altitude in a non-powered state before the ejection charge releases the recovery system (parachute). Thrust is the launching force provided by the rocket engine. The force is created by the ejection of the expended fuel gases through the engine nozzle at high velocity.

A model rocket engine consists of a fuel and an oxidizer compressed into a cardboard tube. The most common motor contains black powder (sulphur, charcoal, and a nitrate) and is available in sizes "1/4 A" through "O", each size providing twice the total impulse of the previous size (i.e. "1/2A"=1.25 N-sec, "A"=2.5 N-sec, "B"=5 N-sec, etc.). To start the engine, a wire igniter is inserted into the nozzle of the engine and held in place with a plastic plug. An electrical current from a battery pack (typically 4 "AA" sized batteries) energizes the igniter, which then generates heat to cause ignition of the fuel. The energy created by the chemical reaction expels the plastic plug from the nozzle and creates thrust, leading to the propulsion (launch) of the vehicle.

Model Rocket Cars

The petitioner has developed two prototype model rocket cars. The smaller car, named "Blurzz," is shaped like a rail dragster - a type of custom-made competitive drag racer consisting

[2] 16 CFR Ch. 11 §1500.85 Exemptions from classification as banned hazardous substances.

of a long narrow shape to reduce aerodynamic drag and increase speed. The car uses the "A" size engine. The larger prototype, named "Screamin' Eagle," is similarly shaped for aerodynamics and resembles a rocket on wheels. The Screamin' Eagle uses the "D" size engine. Both of these cars are designed for use with a nylon tether to provide and control the direction of travel. The tether passes through the undercarriage of the prototypes and is also affixed to the rocket engine holder. The rocket engine is inserted into the holder at the rear of the cars, and is activated by the igniter. The igniter is energized by a separate control mechanism that includes a safety interlock to prevent unintentional ignition of the engine.

Other Propelled Model Cars

Pellet-powered model cars (allowed under an exemption to the FHSA) were popular in the 1950s, but have since declined in popularity. The pellet is composed of up to 11.5 grams of black powder. This amount of propellant compares to 4 grams in "A" engines (total weight of propellant, packing, and tube is 7 grams) and 25 grams in "D" engines (total weight of propellant, packing, and tube is 44 grams). The amount of thrust generated depends on the compaction and burn rate of the propellant, and the nozzle configuration of the engine.

Other types of propelled model cars are offered for sale, including models powered by water, forced air, and chemical reaction (the mixture of vinegar and baking soda resulting in a release of gas). None of these "powered" model cars can attain the speeds reported for the prototype rocket powered units.

While not commercially available, model cars propelled by model rocket motors have been used by hobbyists and do-it-yourselfers since the 1970s, as shown in articles in hobbyist magazines (Extreme Rocketry, Sports Rocketry) and on computer web sites (www.garlitsrocketracing.com). However, due to the requirements of the FHSA, there has been no known commercial sale of model rocket-powered cars in the US.

Other specialty rocket-powered model cars are being used in the US. These are larger cars (weighing upwards of 100 pounds), which use much higher-powered rocket motors ("G" motors and larger). These high-power cars use remote controls for steering and are commonly run in large, flat areas (such as the Bonneville Salt Flats). One group, the National Model Rocket Car Association, conducts tests and competitions involving these cars. The extent of use and sales of these specialty rocket cars is not known. The products are not marketed to children and are therefore not subject to the FHSA requirements. The use of these specialty cars is most likely confined to professionals and serious enthusiasts.

Informal Testing and Engineering Issues

Two tests of prototype model rocket cars provided by the manufacturer were conducted at the Commission's Engineering Lab. These tests included test runs as directed by the manufacturer, as well as reasonable and foreseeable use and misuse scenarios developed by CPSC staff. The manufacturer's instructions were followed and the tether line was stretched out over the chosen course for the cars. The smaller car (*Blurzz*) required 100 feet of smooth

pavement. The larger car (*Screamin' Eagle*) required 600 feet of smooth pavement. In all cases where the manufacturer's instructions were followed, the cars operated along the tether line.

During the informal tests conducted by CPSC, the *Screamin' Eagle* became airborne and reached a height of about 4 feet while remaining tethered. The test showed that model cars have the potential to leave the ground and can become airborne even though they are tethered, and that there is some freedom of motion within the tether system. Anyone standing near or straddling the tether line becomes a potential target. Any resulting injuries with the use of rocket cars would be dependent on the size of the model and the rocket motor, the model material, the kinetic energy and trajectory of the vehicle, and the part of the body that may be struck by the vehicle.

During tests conducted to simulate potential 'misuse', the cars were operated without the use of the tether system. In all cases, the cars traveled haphazardly forward, quickly expending their fuel. There was no indication during the reasonable and foreseeable use and misuse tests that the car could change direction and travel back towards the operator. It was clear, however, that anyone standing forward of the launch site could be in the potential path of a non-tethered, uncontrolled vehicle. Because of the particulars of rocketry, namely the flight path, the greatest potential for injury exists during the launch phase of the activity in the area immediately surrounding the launch site. Clearly, any misuse of the launch pad - aiming or use on an uneven surface - would increase the potential for injury.

After review of the informal in-house tests, witnessing/conducting non-tethered operation, Engineering Sciences staff concludes that the tether system not only restricts and/or defines the direction of travel for the surface vehicle, but also provides a significant increase in the performance characteristic of the vehicle. However, due to the horizontal and vertical freedom within the tether system, the potential for injury exists to those within the boundaries of the rocket cars' path.

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: August 02, 2001

TO : Terrance R. Karels, Economic Analysis,
Project Manager, Petition HP 01-2
Directorate for Economic Analysis

THROUGH: Mary Ann Danello, Ph.D., Associate Executive Director,
Directorate for Health Sciences
Lori E. Saltzman, M.S., Director,
Division of Health Sciences

FROM : Jason R. Goldsmith, Ph.D., Physiologist,
Directorate for Health Sciences, x-1387

SUBJECT : Petition HP 01-2

This memorandum has been prepared in response to Petition HP 01-2, which requests that the Commission exempt certain model rocket propellant devices for vehicles that are intended to travel on the ground along a tethered line.

BACKGROUND:

Under the provisions of the FHSA, toys that contain a hazardous substance that is accessible by a child are banned, unless exempted by Commission authority. The Commission has exempted propellant devices meeting certain requirements used in light-weight, recoverable, and reflyable model rockets. The petitioner, Centuri Corporation president, Barry Tunick, seeks to have similar requirements apply to certain propellant devices that are used for model rocket vehicles that are intended to travel on the ground along a tethered line, such that they too would be exempt from the definition of banned hazardous substance. The model rocket vehicles to which this exemption would apply are not currently marketed and are of two types: a small car that would use a Class A propellant engine, and a larger vehicle that would use a Class D engine. Both classes of engines are presently in use in model rocketry.

The petitioner has provided specifications for the rocket cars and engines, promotional materials, and a marketing study on the proposed products. Additionally, Centuri Corporation provided a live demonstration of the model rocket vehicles to the CPSC staff at the CPSC laboratory facility on April 24, 2001. Subsequently, CPSC staff performed an independent demonstration of the vehicles at the laboratory. Both sessions were videotaped. Demonstration of these products, under prescribed conditions and those that are reasonably foreseeable (e.g., untethered, or on pavement that is not level or entirely free of debris) revealed that the products have the potential

to 1.) misfire, 2.) travel along unpredictable paths when untethered, 3.) become airborne in both tethered and untethered conditions, and 4.) impart significant energy to objects in their path (even after the engine has ceased firing). Speeds in excess of 80 miles per hour were recorded.

The Division of Hazard Analysis staff (R. Ingle, 2001) examined CPSC databases over a 20-year period for injury incidents in which model rockets, their engines, or model airplanes were involved. Thirty-five cases were identified. Health Sciences considered 15 nonfatal injury incidents related to model rockets and/or model rocket engines. These cases did not appear to involve product misuse. Most of these injuries were burn/explosion injuries associated with rockets or rocket engines igniting or exploding.

Based on a review of the materials provided by the petitioner, a review of the videotaped initial demonstration, participation in the independent demonstration, and a review of the injuries associated with model rocketry, the Health Sciences' staff has assessed the types of injuries that may occur as a result of consumer use of these two model rocket vehicles.

DISCUSSION:

The types of injury resulting from impact by one of these vehicles are dependent on the size of the model and propellant engine used, the kinetic energy and trajectory of the vehicle at the time of collision, and the anatomical region of the body that is impacted by the vehicle. Collision with one of these vehicles has the potential to produce bruises, abrasions, and lacerations, to more serious injuries, such as ocular and other facial trauma, fractures, and burns.

Vehicle impact with the eye could potentially cause a rupture of the globe, swelling of the eye, detached retina, hyphema (blood pooling between the cornea and iris), and blow-out fractures of the orbital floor (fracture of the thin-walled bone underlying the eye). These injuries can result in the loss of the eye (loss of binocular vision), blindness, or visual distortions. Collision with the nose could lead to laceration and/or fracture injuries. Collision with the mouth could also produce laceration injuries as well as fracture, displacement (such as movement of the teeth up into the gums), or avulsion (partial or complete loss) of the teeth.

In addition to the above fractures, impact of these vehicles at higher kinetic energies could produce fractures of other small bones, such as the bones of the hand or feet.

Impact by a vehicle whose engine is still firing, or any other exposure to the flame of an engine (such as during close observation of a launch or during launch problem solving), presents a risk of burn injury. Burn injuries to the skin are classified as first-, second, or third-degree burns according to the depth of the burn. The area of the body that receives the greatest amount of heat will be the area of deepest injury. The severity of injury may be influenced by the properties of the flame and the duration of contact with the skin. Burn severity will depend on the total surface area of skin involved, the specific burn site, and the depth of the burn. Severe burn injuries (i.e., full thickness burns) may lead to months of hospitalization, multiple surgical procedures (e.g., debridement and grafting), rehabilitation therapy, disfigurement, loss of limbs and/or mobility, and can potentially be fatal.

Were the engine's nozzle to be blocked due to a manufacturing defect or intentional or unintentional obstruction, there is also the risk of injury due to explosion (personal communication, Patrick Race, Neal Gasser). An explosion of a rocket engine could produce bruises, abrasions, lacerations, or more severe injuries, including burn injuries or impalement injuries caused by flying pieces of debris.

CONCLUSION:

Operation of the proposed model rocket vehicles poses the risk of serious injuries, including burn injuries, ocular or facial injury, and fractures of small bones.

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UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: 7/16/01

TO : Terrance Karels, Project Manager,
Model Rocket Surface Vehicles
Directorate for Economic Analysis

THROUGH: Hugh McLaurin, Associate Executive Director,
Directorate for Engineering Sciences
Robert B. Ochsman, Ph.D.
Director, Division of Human Factors

FROM : Sharon R. White, ESHF

SUBJECT : Petition to Exempt Model Rocket Motors
For Use with Certain Model Rocket Cars

I. Background

Model rocket motors designed for use in light-weight, recoverable, and reflyable model rockets have been exempted from classification as banned hazardous subtances if they meet certain requirements. Centuri Corporation petitioned the Commission to expand the current exemption for model rocket motors designed for use in certain model rocket cars. The cars travel on the ground along a tethered line that serves as a track for the cars.

A. Product Description

The model cars are Centuri's large (Screamin' Eagle) model, intended for ages 18 and up and the small (Blurzz) model car for ages 12+. The Screamin' Eagle, which comes disassembled, requires the user to build the car. When fully assembled, it measures 18 ¾ -in. long x 7 ¾-in. wide and weighs 6.5 oz. The Blurzz already comes assembled and is 12 ½-in. long x 3 5/8-in. wide and weighs 2.7oz. Both models are powered by an engine that is ignited by a battery-operated controller. However, the Screamin' Eagle requires a D engine while the Blurzz requires an A engine. Motor power ranges from "A" (the smallest) to "G"(the largest) for model rockets. The "A" motor for the smaller vehicle has 2.5 newton seconds of impulse with thrust duration of .8 seconds while the "D" motor for the larger vehicle has 20 newton seconds of impulse with thrust duration of 2 seconds. When ignited, the Screamin' Eagle is intended to travel a 500ft. tethered line, and according to the firm, if the surface is ultra smooth, may run at speeds up to 55 miles per hour. The Blurzz is intended to travel along 100 ft. of tethered line, and may run at speeds of 30 miles per hour on an ultra smooth surface. Both models have a parachute brake system.

B. Human Factors Issues

To address the petition, Human Factors was requested to determine for whom the toys are likely to be purchased and used by; the likelihood that a child would operate the vehicles untethered and if so, how often; the adequacy of the instructions and the label; and whether a child would be likely to read and heed the label.

II. Discussion

A. For What Ages are these Model Rocket Cars Likely to be Purchased for and Used by?

The larger, more powerful vehicle is age graded by the manufacturer for ages 18 and older and the smaller, less powerful one is age graded for children ages 12+. However, adults are likely to purchase these vehicles for children younger than the intended age. According to *the Guidelines for Relating Children's Ages to Toy Characteristics*, 1985, combustion flyable rockets are appropriate for children around age 12, but can be operated with adult supervision by slightly younger children (age 10 or 11). A consumer study conducted by the Hobby Industry of America (1988), found that approximately 25 percent of model rocket users are under the age of 12, and approximately 28 percent of model rocket (reloadable and non-reloadable) users are between the ages of 12 and 17. Therefore, if these children can operate flyable model rockets whose trajectory may be erratic, then they can handle the tethered model rocket ground vehicles whose course is comparatively more controlled. The issue, therefore, becomes which vehicle is likely to be purchased for which age child. Several factors need to be considered, including the characteristics of the product and the motor that powers the product, and characteristics of the child.

The larger vehicle is age graded for ages 18 years and older, but the more powerful "D" motor that powers it is age graded on the product package by the firm for "... Ages 10 and up. Adult supervision for those under 12..." Since the vehicle is powered by the motor, the recommended age on the motor package is a factor likely to influence for whom the vehicle is purchased. This means adults are likely to purchase it for children ages 12 years and older. Additionally, children of this age are still uneven in their development, but they are developing mature, nearly adult forms of reasoning. This may enable them to better understand the potential danger inherent in the fuel system and in the extent of possible harm if objects or people are hit by the moving vehicle. Also, model making is of interest to these children and therefore this model would appeal to them. Additionally, children this age can read, understand, and remember complex instructions. Thus, they may be capable of handling the more difficult instructions that come with this product, although adult assistance may be required. Further, the packaging of the product, though adult in theme, may appeal to these children who are interested in complex building sets and motorized systems. Therefore, the large model rocket vehicle is likely to be purchased for and used by children ages 12 years and older.

The smaller, less powerful vehicle, which is age graded for 12 years and up, requires an "A" motor that is age graded on the product package for "...Ages 10 and up..." This is likely to influence the purchase for children ages 10 years and older. Additionally, the overall appearance of the packaging is likely to influence the purchase of this product for this age child. It has a juvenile appearance with a cartoon racing theme on one side and on the other, pictures of children racing. One of the pictures appear to be that of a 10-year-old child which may attract similar aged children. Also, the packaging states that the product is quick to set up. Unlike the larger vehicle, the smaller vehicle comes already assembled. The user need only set up the tether. This may appeal to some parents of children of age 10 who usually have difficulty solving problems on their own. Therefore, this vehicle is likely to be purchased for and used by children ages 10 years and older.

B. What is the Likelihood that a Child would Operate the Vehicles Without the Tethered Line? If a Child does so, what is Frequency of Occurrence?

Human Factors reviewed Century Corporation Estes Industries marketing study for this response. Estes Industries conducted a qualitative marketing study of boys ages 8-14 (half are rocket users and half are not) and of mothers of boys ages 8-12 (half are rocket users and half are not) regarding consumer interest and concerns. It is a 3-phase study, consisting of an observation study and interview with the boys and a focus group with the mothers who saw a demonstration of the product by the experimenter. The smaller, Blurzz vehicle was tested for this study.

The study revealed that for the boys, speed and excitement are the chief attraction of this product and that, unanimously, the race line is preferred because it assures speed and control. None of the boys suggested eliminating it. However, this is a product (and the larger one, too) that involves a repetitive play pattern (set up and launch over and over again) in which the tethered vehicle is intended to travel in the same direction without altering its course. Because of the repetitive play nature of the product, it may lose its power and effect and bore its users. This was a recurring theme throughout the study among some of the boys and the mothers. Typical responses from the boys include: "the car is always going the same way – there's nothing different – that might get boring" (13), "would get tired of it" (11), "it's just the same thing"(11). Therefore, launching the vehicle off the track may become an attractive alternative. This is illustrated in the study when an 11-year-old stated, "...to try it without the string just to see how it would work..." and a friend agrees, stating, "...interesting to see if it would go in the air or spin around." A 13-year-old stated that the "string is good so the car won't go off somewhere, but would want to see what would happen without the string – might curve instead or go straight." During the focus group discussion, one mother envisioned her son cutting off the string as a short-term experiment. She stated, "at first they'll do what it says, then they'll see what else it can do." Therefore, based on the repetitive nature of the product and the subjects' responses during the interview with the boys and the focus group discussion with the mothers, it is likely that some of the users may experiment and launch the vehicle without the race line. This is likely if children play by themselves or with friends and less so during family outings where adult supervision is heightened.

As with all studies conducted by those who have a proprietary interest in the outcome, there are some inherent limitations and therefore, these results must be viewed with appropriate scientific reservation. For example, one defect of this research is omission of the larger, more powerful vehicle. However, its overall theme, function, and repetitive nature is identical to that of the smaller vehicle. Therefore, some children who would receive the larger one are just as likely to launch it off the tether as they would the smaller one. This may have been demonstrated in the study if it had been tested.

Off the tether, neither vehicle travels on a straight, predictable course. This was demonstrated during testing of one of the toy vehicles at the CPSC Engineering Laboratory. In two of the three tests performed with the vehicle untethered, the vehicle went off course and tumbled haphazardly on the ground. Untethered use clearly resulted in slower and shorter runs.

As earlier noted, the chief attraction of the vehicles is the speed which the tether assures. Thus, on subsequent uses, children would likely launch a vehicle using a tether. This is especially true during a game of racing. However, as stated earlier some children may launch a vehicle off the track to show it off to a friend.

Children may use a vehicle in other ways to discover what else may be done with this product. According to Estes' interview portion of the marketing study, some children may use it with a ramp, set up barriers, and experiment with different string tensions. If they do so, such uses may have a similar effect as when using it off the tether. This is confirmed by the firm's assembly instructions for both vehicles where they suggest that use with a ramp could cause the cars to become airborne. Additionally, on page 9 of the firm's revised test report, when the larger, Screaming Eagle vehicle was tested with slack in the line, it "flipped over, jumped in air".

Lab testing showed even when used according to directions, the toy could go out of control. During testing, at about 100 to 110 feet down the tether, the toy vehicle became airborne about 4 feet (still tethered) and flipped over backwards on the ground, travelling down the tether on its back a few more feet. Debris or a bump in the test surface may have been contributing factors. Just prior to this test, the launch was successful, however. Irregularities in, and debris on the road are common and may cause these fast-moving vehicles to lose control even while tethered.

C. Are the Instructions Adequate?

The reading level required to understand the product instructions for the large and small vehicle, according to Flesch-Kincaid Grade Level (a method that computes a readability score) is fifth grade (ages 10-11). As earlier indicated, adults are likely to purchase the large vehicle for children ages 12 years and older and the smaller one for ages 10 and up. Therefore, it is likely

that children in the respective ages would be capable of reading the instructions. However, this readability measure does not consider the effectiveness of the visuals used which are critical to the instructions or whether steps are omitted. Therefore, these would need to be considered as part of the overall evaluation of the instructions.

The instructions for the large vehicle are of the fold-out type with 6 pages of text and visuals printed on the front and back of the sheets. Steps 3 (assembling front wheels) and 4 (assembling rear wheels) requires 6 and 4 steps, respectively. However, there is only one visual for each wheel which is intended to serve as the illustration for all of the steps. This is not an effective visual nor a recommended practice and may be confusing for some children, and adults who may be requested to assist. In step 5, the front line guide attaches to the front wheel housing by first inserting a portion of the guide through a small hole in the housing, then by using a screw. The written instructions do not mention the small hole nor does the visual adequately show it. Thus, neither a child nor an adult is likely to look for it, but may notice it through trial and error. The overall instructions contain too many visuals on a page, which may make it difficult for users to focus on any one visual to help them through a procedure. Unless improvements are made to the instructions, some children may have difficulty following them.

For the smaller vehicle, the instructions are not listed vertically by number but, rather rely on arrows at points in the instructions to get a user through a procedure. Depending on the location of the text in the instructions, the direction of the arrow changes. According to Estes marketing study, these instructions were not easy to use, because the "...sequence was not precise enough in the step-by-step set up." Therefore, while the instructions may be easy for these children to read, they may be difficult for some to follow.

D. Is the label adequate and will a child read and heed the label?

A warning label is displayed on pages 1, 4, 5, and 6 of the instructions for the large vehicle. On page 1, the label states – **CAUTION!** Use only alkaline batteries. Do not mix old and new batteries or batteries of different types. The label on page 4 states – **WARNING: DO NOT OPERATE THE CAR WITHOUT THE PARACHUTE BRAKE SYSTEM.** Inspect the parachute after each race and replace if ripped, torn or disconnected from Parachute line guide. On page 5, the label reads – **WARNING: FLAMMABLE** – Before proceeding read instructions & NAR safety code included with engines. **PREPARE YOUR ENGINE ONLY WHEN YOU ARE OUTSIDE AT THE RACE SITE PREPARING TO RUN!** If you do not use your prepared engine, remove the igniter before storing your engine. On page 6, it reads – CAUTION! – ALWAYS HAVE SAFETY KEY REMOVED FROM THE ENGINE STARTER BEFORE CONNECTING TO IGNITER AND IMMEDIATELY AFTER IGNITION!

The instructions for the smaller vehicle contain four warning labels. They are as follows: WARNING: Never store an engine with the igniter installed!; **CAUTION!** Clear the track of any stones and debris. DO NOT step on race line at anytime. DO NOT allow anyone to cross racetrack once set up – KEEP RACTRACK CLEAR AT ALL TIMES!; **CAUTION!** Use only alkaline batteries. Do not mix old and new batteries or batteries of different types; and WARNING: Before proceeding, READ ENGINE INSTRUCTION INCLUDED WITH ENGINE and ROCKET RACING SAFETY CODE. PREPARE ENGINES ONLY OUTSIDE

AND ONLY WHEN YOU ARE READY TO RACE! NEVER carry or store engines with igniter installed!

Researchers contend that an effective warning label is one that is noticed, then read and understood, and induces compliance. The ability to perceive a hazard does not exist equally in all children, but is a complex process influenced by both individual and situational factors. For example, in an experiment on the effectiveness of NO DIVING signs regarding the risk of shallow water diving, the majority of the middle and high school students who participated in the experiment did not recall seeing the warning sign during a 4-week period that the sign was posted in a conspicuous location. The warning labels in the assembly instructions are buried and may not attract attention. Therefore, based on data such as the NO DIVING study, children often do not attend to warnings and the comparatively inconspicuous warnings in the assembly instructions may have little to no influence on children.

Conclusion

The large model rocket vehicle is likely to be purchased for and used by children ages 12 years and older while the smaller model rocket vehicle is likely to be purchased for and used by children ages 10 years and older. Some of the children in both age groups are likely to launch the vehicle without the tether if they play by themselves or with friends and less so during family outings where adult supervision is heightened. Some may use it with a ramp, set up barriers, and experiment with different string tensions which may have a similar effect as when using it untethered. Even when tethered, the vehicle may lose control if it encounters irregularities or debris on the road.

While children in both age groups would be capable of reading the assembly instructions for the vehicles that they would receive, some may have difficulty following them and therefore, may require adult assistance, at least during the initial set up. The warning in the assembly instructions may not attract a child's attention and are, therefore, likely to have weak impact on children's behavior.

References

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