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UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
4330 EAST WEST HIGHWAY
BETHESDA, MD 20814

DATE: September 16, 2020

TO: The Commission
Alberta E. Mills, Secretary

THROUGH: Mary T. Boyle, Executive Director
John G. Mullan, General Counsel
Hyun S. Kim, Acting Assistant General Counsel

FROM: Barbara E. Little, Attorney, OGC

SUBJECT: Recreational Off-Highway Vehicles (ROVs)—Termination of Rulemaking

BALLOT VOTE DUE: Tuesday, September 22, 2020

Staff is forwarding a briefing package to the Commission, recommending that the Commission terminate the rulemaking associated with ROVs that began with the publication of an advance notice of proposed rulemaking in the *Federal Register* in October 2009 (74 Fed. Reg. 55495 (Oct. 28, 2009)).

Please indicate your vote on the following options:

I. Terminate the rulemaking associated with ROVs, and direct staff to draft a *Federal Register* notice for Commission vote, announcing the Commission's termination of the ROV rulemaking.

_____ _____
(Signature) (Date)

II. Do not terminate the rulemaking associated with ROVs.

_____ _____
(Signature) (Date)

III. Take other action. (Please specify.)

_____

_____

_____

_____ _____
(Signature) (Date)

Attachment: Briefing Package: Recreational Off-Highway Vehicles (ROVs)

RECREATIONAL OFF-HIGHWAY VEHICLES (ROVs)

September 2020

For Further Information Contact:

Caroleene Paul
Project Manager
Directorate for Engineering Sciences
(301) 987-2225

EXECUTIVE SUMMARY

Background: Recreational off-highway vehicles (ROVs), sometimes referred to as side-by-sides, are motorized off-road vehicles that combine off-road capability with utility and recreational use. In October 2009, the Commission published an advance notice of proposed rulemaking (ANPR) to consider whether there may be unreasonable risks of injury and death associated with ROVs due to inadequate rollover resistance (lateral stability), inadequate vehicle steering/handling characteristics, and inadequate occupant protection.

In November 2014, the Commission published a notice of proposed rulemaking (NPR), based on staff's evaluation that vehicle rollover and occupant ejection remained primary hazards and staff's assessment that the voluntary standards for ROVs, ANSI/ROHVA 1-2010 *American National Standard for Recreational Off-Highway Vehicles* and /OPEI B71.9-2010 *American National Standard for Multipurpose Off-Highway Utility Vehicles*, did not adequately address those hazards. In the NPR, staff proposed requirements to increase the rollover resistance (lateral stability) of ROVs, establish predictable and controllable steering/handling of the vehicle, and increase occupant protection performance in rollover events.

In April and May 2016, the two standards development organizations (SDOs) for ANSI/ROHVA 1 and ANSI/OPEI B71.9 revised their standards to address rollover resistance (lateral stability), steering/handling characteristic and occupant protection/ejection. The new requirements became effective with model year 2018 vehicles. In November 2016, staff evaluated the revised voluntary standards and determined that the new requirements adequately address the rollover and occupant ejection hazards. Staff expected substantial compliance with the voluntary standards by 2018because the members of the SDOs who developed the standards sold more than 90 percent of the ROVs in the United States.

In November 2016, staff submitted a briefing package to the Commission, recommending that the Commission terminate rulemaking on ROVs. However, the Commission voted to deny termination and approved a motion to conduct a retrospective review of the voluntary standards no later than 2 years after the effective date of those standards. The purpose of this briefing package is to provide the Commission with staff's updated assessment of ROV hazards and of the adequacy of the voluntary standards for ROVs in addressing those hazards, as well as staff's assessment of the level of compliance with those voluntary standards and retrospective review of the voluntary standards. This package examines only the aforementioned hazards associated with ROVs that are the subject of the current ROV rulemaking.

Evaluation of Voluntary Standards: As of December 31, 2019, CPSC staff is aware of 1,236 reported ROV-related incidents, involving at least one death or injury, that occurred on or after January 1, 2012 through December 31, 2019. CPSC staff reviewed 846 completed In-Depth Investigations (IDIs) from the 1,236 identified reports of ROV-related incidents to determine hazard pattern characteristics.[1] Of the 846 IDIs, 593 (70 percent) involved lateral rollover of the vehicle. Of the 593 lateral rollovers, 333 (56 percent) occurred in a turn, or due to loss of control of the vehicle, with more than half (174 incidents, 52 percent) occurring on a level surface. From the 846 IDIs, staff determined 637 incidents resulted in a fatality of one or more occupants who

[1] Received as of December 31, 2019. All incident analysis is based on reported information.

were ejected from the ROV. Of those 637 incidents, the fatally injured occupants in at least 509 incidents (80 percent) were not wearing their seat belts. Occupants who did not wear their seat belt experienced partial to full ejection from the ROV, and many victims were struck by the ROV after ejection.

Based on the incident data, CPSC staff concludes that ROV rollover and occupant ejection are the primary hazards to address. These hazards can be addressed by: improving the rollover resistance (lateral stability) of the vehicle, ensuring predictable and controllable steering/handling of the vehicle, and increasing the occupant protection performance of the vehicle.

CPSC staff evaluated the rollover resistance (lateral stability), vehicle steering/handling, and occupant protection performance requirements for ROVs in ANSI/ROVHA 1-2016 and ANSI/OPEI B71.9-2016. Staff concludes that the voluntary standards are likely to reduce the occurrence of ROV rollovers at lower speeds on flat terrain by increasing rollover resistance (lateral stability) and prohibiting uncontrollable steering of the vehicle; staff also concludes that the voluntary standards are likely to reduce the occurrence of occupant ejection during rollover events by increasing seat belt use and containment of the occupant in a rollover. For these reasons, staff concludes the current voluntary standards will adequately address the risk of ROV rollover and occupant ejection.

Staff estimates that at least 90 percent of ROVs currently being sold in the U.S. comply with ANSI/ROHVA 1-2016 and ANSI/OPEI B71.9-2016, based on ROHVA and OPEI participation in developing these standards and recent information from the associations and manufacturers regarding vehicle compliance with the standards.

Retrospective Review: To conduct its retrospective review, staff used the 846 completed IDIs of reported incidents from 2012 to 2019 to confirm that ROV rollover and occupant ejection are primary hazards that can be addressed by voluntary standards requirements on lateral stability, vehicle handling, and occupant protection. Given that the incidents reviewed do not constitute a statistically-derived sample of ROV-related incidents, and staff has no exposure data with which to compare, staff is unable to relate these incidents to an assessment of effectiveness of the voluntary standard.

CPSC staff believes that at least 90 percent of ROVs sold in the United States comply with the ANSI/ROHVA 1-2016 and/or ANSI/OPEI B71.9-2016. Staff also anticipates future compliance rates will remain at about 90 percent.

CPSC staff do not believe the provisions in the voluntary standards on Lateral Stability, Vehicle Handling, and Occupant Protection need to be made more stringent in order to provide necessary protections for consumers.

CPSC staff do believe the standard needs to be updated to address thermal and debris penetration risks not addressed in the current standard and are actively engaged with the standards organization to address these hazards.

Conclusion: Staff believes that the revised voluntary standards are likely to (1) reduce the occurrence of ROV rollovers by improving lateral stability and steering/handling characteristics of the vehicle, and (2) reduce the occurrence of occupant ejection during rollover events by increasing seat belt use and containment of the occupant in a rollover. Staff assesses that there is a high level of compliance with the standard by the major ROV manufacturers. For these reasons, staff recommends that the Commission terminate the existing rulemaking on ROVs related to inadequate rollover resistance, inadequate vehicle steering/handling characteristics, and inadequate occupant protection. Staff continues to pursue voluntary standard development to address thermal issues and debris penetration hazards for ROVs.

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Memorandum September 16, 2020

TO: The Commission
Alberta E. Mills, Secretary

THROUGH: John G. Mullan , General Counsel
Mary T. Boyle, Executive Director

FROM: Duane E. Boniface, Assistant Executive Director
Office of Hazard Identification and Reduction
Caroleene Paul, Project Manager
Directorate for Engineering Sciences

SUBJECT: ROV Termination Briefing Package

I. BACKGROUND

Recreational off-highway vehicles (ROVs) are motorized vehicles that have four or more tires, non-straddle seating, automotive-type controls for steering, throttle, and braking, and a maximum vehicle speed greater than 30 miles per hour (mph).[2] ROVs combine off-road capability with utility and recreational use, and they are increasingly popular in the United States. Reports of ROV-related fatalities and injuries prompted the Commission to publish an advance notice of proposed rulemaking (ANPR) in October 2009 to consider whether there may be unreasonable risks of injury and death associated with ROVs (83 FR 14447). CPSC staff's review of the incident data for the period 2003 to 2009 identified vehicle rollover and occupant ejection (and subsequent crushing by the vehicle) as primary hazard patterns. Staff's preliminary evaluations of several ROV models on the market at that time indicated that the vehicles may exhibit inadequate lateral stability, undesirable steering characteristics, and inadequate occupant protection during a rollover. The ANPR also summarized staff's engagement in 2008 and 2009 with the Recreational Off-Highway Vehicle Association (ROHVA) in the development of ANSI/ROHVA 1, *American National Standard for Recreational Off-Highway Vehicles*, in which staff expressed concerns with the lateral stability and occupant protection aspects of the ROV class of vehicles. At the time the ANPR was published, ANSI/ROHVA 1 was a draft standard, and staff determined that it did not adequately address the hazards posed by vehicle rollover and occupant ejection.

In November 2014, the Commission published a notice of proposed rulemaking (NPR) to address the rollover resistance (lateral stability), steering/handling, and occupant ejection hazards associated with ROVs. In the NPR, CPSC staff reviewed ANSI/ROHVA 1-2010, *American National Standard for Recreational Off-Highway Vehicles* and another voluntary standard that had been revised to include requirements for ROVs, ANSI/OPEI B71.9 *American National Standard for Multipurpose Off-Highway Utility Vehicles.* CPSC concluded that the static stability and dynamic stability requirements in the voluntary standards at that time would not improve the

[2] Definition from ANSI/ROHVA 1 *American National Standard for Recreational Off-Highway Vehicles.*

lateral stability of ROVs and provided no incentive for manufacturers to improve the lateral stability of ROVs. The voluntary standards also did not have requirements for vehicle steering/handling. Therefore, CPSC concluded that the standards did not adequately address rollover hazards caused by loss of control of the vehicle associated with undesirable steering/handling. Lastly, CPSC concluded that the voluntary standard requirements for seat belt reminders and occupant retention would not adequately increase seat belt use and occupant protection in ROVs.

To address the risks of death and injury associated with lateral rollovers and occupant ejection, the Commission proposed performance requirements for:

- Minimum vehicle rollover resistance, as measured by a dynamic test,
- A hang tag displaying the vehicle's rollover resistance on a progressive scale;
- Understeer vehicle handling characteristics, as measured by a dynamic test;
- Limiting maximum speed of an ROV to no more than 15 miles per hour (mph), unless the seat belts of both the driver and front passengers, if any, are fastened; and
- A minimum level of side retention by requiring a passive shoulder barrier.

After publication of the NPR, CPSC staff continued to work closely with ROHVA and OPEI to develop changes to the voluntary standards to address vehicle stability and occupant protection. In April and May 2016, ROHVA and OPEI revised their respective standards to address staff's concerns with hazards associated with vehicle rollover and occupant ejection. ROHVA and OPEI's revised voluntary standards:

- Modified lateral stability requirements, by revising the tilt table requirements;
- Introduced a new requirement for a hang tag, which displays the maximum tilt table performance of the vehicle;
- Introduced new vehicle handling requirements that prohibit severe oversteer, which can lead to uncontrollable steering;
- Revised occupant protection requirements by requiring a seat belt reminder that limits maximum vehicle speed to 15 mph if the driver's seat belt is not buckled; and
- Revised occupant protection requirements by requiring more robust seat belt performance and side retention barrier performance.

In November 2016, staff submitted a briefing package to the Commission that recommended terminating rulemaking on ROVs. CPSC staff evaluated the lateral stability, vehicle handling, and occupant protection performance requirements for ROVs in ANSI/ROHVA 1-2016 and ANSI/OPEI B71.9-2016 and concluded that the revised voluntary standards are likely to: (1) reduce the occurrence of ROV rollovers by increasing lateral stability and prohibiting uncontrollable steering; and (2) reduce the occurrence of occupant ejection during rollover events by increasing seat belt use and improving side retention.

The ANSI/OPEI B71.9-2016 standard took effect on August 2, 2018. ANSI/ROHVA 1-2016 stated that the standard "becomes effective beginning with 2018 model year vehicles, but earlier compliance is permitted." In the November 2016 briefing package, staff concluded that more than 90 percent of ROVs were likely to comply with the voluntary standards by their effective

dates because ROHVA and OPEI members were active in developing the voluntary standards and their members represented about 90 percent of ROVs sold in the United States.

Based on staff's assessment of the voluntary standards and likely compliance with them, staff recommended that the Commission terminate rulemaking on ROVs. However, on January 25, 2017, the Commission voted 3-2 to deny termination of the rulemaking to promulgate a safety standard for ROVs. The Commission also voted 3-2 to approve a motion providing for retrospective review of the voluntary standards for ROVs no later than 2 years after the effective date of those standards.

This package summarizes the analyses performed by CPSC staff to evaluate the requirements in the voluntary standards for ROVs, the compliance with those requirements, and whether compliance with those requirements is likely to adequately reduce the risk of injury identified with ROVs. Staff also provides a retrospective review of the standards based on available incident data and sales data of ROVs in the United States.

II. EVALUATION OF VOLUNTARY STANDARDS

In this section staff assesses the hazards associated with ROVs that present an unreasonable risk of injury and whether the voluntary standard requirements adequately reduce the risk of injury associated with those hazards.

A. Hazards associated with ROVs

While developing the NPR in 2014, staff reviewed NEISS and CPSRMS data involving ROVs. The information in the NPR package covered reported incidents that occurred from January 1, 2003 through April 5, 2013. To analyze hazard patterns related to ROVs, staff relied on a team review of 428 reports of ROV-related incidents that occurred between January 1, 2003 and December 31, 2011.

While developing the voluntary standard assessment package in 2016, staff provided updated incident data on ROVs to include reported incidents that occurred between January 1, 2003 and August 26, 2016. However, to assess the voluntary standards, staff relied on the hazard patterns previously identified in the review of 428 ROV-related incidents from the NPR.

To assess the voluntary standards for this package, staff conducted an updated team review of reported ROV-related incidents that occurred between January 2012 and December 2019. As of December 31, 2019, CPSC staff is aware of 1,236 reported ROV-related incidents, involving at least one death or injury, that occurred on or after January 1, 2012 through December 31, 2019. The 1,236 reported incidents involved at least 2,479 persons (including 980 deaths, at least 1,094 non-fatal injuries, and others not necessarily injured). It is important to emphasize that data collection is ongoing, and these counts are expected to increase as CPSC staff obtains additional information regarding ROV-related incidents during this period.

CPSC staff successfully completed in-depth investigations (IDIs) for 846 of the 1,236 identified reports of ROV-related incidents discussed above. Staff reviewed these 846 IDIs because

documents reviewed as part of the IDI, such as police and coroner reports, often contain more detailed information on the events surrounding the incident than NEISS narratives or other reports. Staff used this information to determine patterns in the hazards, such as vehicle overturn or collision, plus other details, such as vehicle maneuvers before the event, occupant seat belt use, and occupant ejection status, and occupant injury severity.

The investigations reviewed are anecdotal in nature and do not constitute a statistically derived sample of ROV-related incidents, nor do they represent a complete set of incidents that may have occurred. Therefore, the data should not be used to make national estimates of ROV incidents or injuries (fatal or non-fatal). However, the investigations provide at least a minimum count for the number of incidents and specific details in the investigations allow staff to assess hazards associated with ROVs. The circumstances associated with ROV-related incidents are often complex, involving a number of events, and sometimes conflicting information in the medical and police reports. A review team considered the events and descriptions reported in each investigation and determined hazard codes based on all the information available.

Staff identified the following ROV hazard patterns from the review of the 846 IDIs:

- Overturning: The vehicle reportedly overturned forward, backward, sideways (rollover), or in an unknown direction (UNK).
- ROV collision: The ROV struck (or was struck by) another vehicle; or the ROV struck a stationary object (*e.g.*, rock, tree, gate).
- Fire: The ROV caught fire.
- Thrown/Fell: One or more occupant fell out of the vehicle in some way (*i.e.*, falling out of the bed of the ROV).
- Drowning: The ROV ended up in water and resulted in drowning one or more occupants.
- Debris penetration: A branch or some other object punctured the ROV and injured one or more occupants.
- Hit by ROV: a bystander was struck by or run over in some way by the ROV.
- Other: Loose door (2 incidents), laceration, and asphyxiation.
- Unknown: There was insufficient detail to determine hazard.

Table 1 shows the total number of incidents, broken out by hazard pattern, for the 846 IDIs.[3]

[3] Some incidents involve more than one hazard; therefore, hazard counts will not total number of incidents.

Table 1. ROV Hazard Patterns for Investigated Incidents that Occurred Between 2012 and 2019

Hazard pattern	Number of incidents
Overturning (sideways, back/forward, both, UNK)	625
ROV collision	134
Fire	32
Thrown/Fell	23
Drowning	18
Debris Penetration	11
Hit by ROV	6
Other	4
Unknown hazard pattern	5

This memorandum focuses on rollover and occupant retention hazards associated with ROVs. Staff continues to study and monitor fire and debris penetration hazards associated with ROVs.

1. ROV Rollover

Of the 846 ROV-related IDIs, 593 (70 percent) involved rollover of the vehicle. More than half of these rollovers (333 incidents, 56 percent) occurred while the vehicle was in a turn and/or involved yaw (*i.e.*, sideways slide of vehicle while it spins), overcorrection, or loss of control of the vehicle. Of those 333 incidents involving rollover in a turn, 174 (52 percent) occurred on a level surface.

2. Occupant Ejection and Seat Belt Use

Of the 846 ROV-related IDIs, staff identified 637 (82 percent) in which one or more occupants were fatally ejected. Of those 637 fatal-ejection incidents, the ejected occupant was not wearing a seat belt in at least 553 incidents (87 percent), and seat belt use is unknown in 64 incidents (10 percent). Of those 553 incidents involving lack of seat belt use, the ejected occupant who was fatally injured did not have a seat belt available in 29 incidents (5 percent) because the occupant was riding on someone's lap or between seat-belted seats, or in the bed of the vehicle. In 15 incidents (2.7 percent), the occupant had bypassed the seat belt by buckling it behind their back. Excluding occupants who bypassed the seat belt, or who were in locations in the vehicle that did not have a seat belt available, occupants in at least 509 of the 637 fatal-ejection incidents (80 percent) were not wearing their seat belts. In addition, of the 64 incidents (out of the 637 fatal-injection incidents) in which seat belt use is unknown, the fatally ejected occupant was pinned by the vehicle in 28 of those incidents (43 percent), indicating a high probability that the seat belt was not used.

B. Addressing Rollover – Improving Lateral Stability and Controllable Steering/Handling

The data indicate that approximately 70 percent of the reviewed investigations involved lateral rollover of the vehicle, and more than half of those rollovers involved turning, often at slow speed on a level surface. Improving the lateral rollover resistance and vehicle steering/handling characteristics of ROVs is a strategy for reducing the occurrence of ROV rollover events. ROVs that exhibit higher rollover resistance are more stable than ROVs with lower rollover resistance. Therefore, increasing rollover resistance of ROVs may reduce the occurrence of rollovers.

More importantly, ROVs that exhibit stable vehicle steering/handling characteristics are less likely to roll over due to loss of control. Many of the incidents involving rollover in a turn specifically mentioned yaw or slide of the vehicle as it spun out of control and tripped into a rollover. Therefore, improving the vehicle handling of ROVs to prohibit uncontrollable steering may reduce the occurrence of rollovers.

1. Improving Lateral Stability

ANSI/OPEI B71.9-2016 and ANSI/ROHVA 1-2016 rely on a tilt table test to measure the tilt table angle of the ROV to define performance requirements for static lateral stability. The tilt table angle is measured by placing the ROV on a rigid platform and tilting the platform (see Figure 1). The angle of the platform relative to the horizontal is the tilt table angle. The vehicle's rollover resistance is measured at the angle when all uphill wheels of the vehicle lift off the platform.

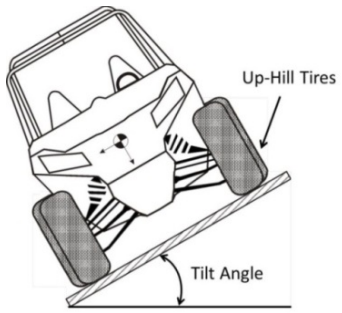

Figure 1. Tilt table angle

Voluntary Standard Requirements for Lateral Stability

Tilt Table Stability. **ANSI/OPEI B71.9-2016 Section 8.6 and ANSI/ROHVA 1-2016 Section 8.1** specify a procedure to place a vehicle, with test weights to simulate two different test load configurations, on a tilt platform and laterally tilt the platform until the vehicle achieves the minimum tilt angle requirements.

A vehicle configured with two occupants must reach a minimum of 33 degrees before lateral tip over, to meet the tilt table requirements. A vehicle configured with the maximum number of occupants and full cargo load must reach a minimum of 24 degrees before lateral tip over, to meet the tilt table requirements.

Tilt Table Hang Tag. **ANSI/OPEI B71.9-2016 Section 5.18 and ANSI/ROHVA 1-2016 Section 4.17** require that vehicles be equipped with a hang tag that provides consumers with the tilt table angle at two-wheel lift for that vehicle when loaded in the operator-plus-passenger configuration. "Two-wheel lift" is defined as the "condition in which the uphill tires are no longer in contact with the test surface."[4]

CPSC Staff's Evaluation

CPSC staff's review indicates that a requirement for a minimum tilt table angle of 33 degrees, by itself, will not increase the rollover resistance of ROVs. Staff contracted SEA Limited (SEA) to measure the tilt table angle, with a 1-inch trip rail, at two-wheel lift, of several model year 2014 and 2015 ROVs.[5] Test results show that the tilt table angles at two-wheel lift ranged from 36.0 to 40.7 degrees. Based on these tests, staff believes that a requirement for a tilt table angle of 33 degrees is very low and easy to achieve; and therefore, this tilt table angle should be considered a baseline minimum requirement.

However, staff's review shows that combining a minimum tilt table angle requirement with a hang tag requirement that displays the vehicle's maximum tilt table angle at two-wheel lift may increase the rollover resistance of ROVs by providing an incentive for manufacturers to increase the rollover resistance of ROVs. NHTSA developed the New Car Assessment Program (NCAP) star-rating system in 1978 to provide consumers with information on the crashworthiness of passenger vehicles.[6] In 2001, NHTSA began including rollover resistance information in its NCAP because it believed that consumer information on the rollover risk of passenger cars would influence consumers to purchase vehicles with a lower rollover risk and inspire manufacturers to produce vehicles with a lower rollover risk.[7,8] A subsequent study of rollover resistance trends in automobiles, as defined by a vehicle's static stability factor (SSF), found that the rollover resistance increased for all vehicles after 2001, particularly SUVs, which tended to have the worst SSF values in the earlier years.**Error! Bookmark not defined.** CPSC staff believes that a similar increase in rollover resistance may be achieved in ROVs with the voluntary standard requirement for a hang tag that displays the rollover resistance of each ROV. With a metric of the ROV's rollover resistance made available to the public, consumers may demand vehicles with higher rollover resistance and manufacturers may have a competitive incentive to increase the rollover resistance of their vehicles. ROVs that exhibit higher rollover resistance are more stable than ROVs with lower rollover resistance. Therefore, increasing rollover resistance of ROVs may reduce the occurrence of rollovers.

[4] The final version of the hang tag was not finalized until 2017. ROHVA provided a copy of the final hang tag in a letter dated June 5, 2017 to Cmmrs. Kaye and Adler.
[5] Heydinger, G. (2015) Tilt Table Measurements on Twenty-Two Recreational Off-Highway Vehicles. Retrieved from http://www.cpsc.gov//Global/Research-and-Statistics/Injury-Statistics/Sports-and-Recreation/ATVs/SEAReportTiltTableResults22ROVsSept2015.pdf.
[6] Hershman, L. (2001). The U.S. New Car Assessment Program (NCAP): Past, Present and Future. Paper Number 390. Retrieved from: http://www-nrd.nhtsa.dot.gov/pdf/nrd-01/esv/esv17/proceed/00245.pdf.
[7] Walz, M. C. (2005). Trends in the Static Stability Factor of Passenger Cars, Light Trucks, and Vans. DOT HS 809 868. Retrieved from: http://www.nhtsa.gov/cars/rules/regrev/evaluate/809868/pages/index.html.
[8] 65 FR 34988 (June 1, 2000).

In summary, the ANSI/OPEI B71.9-2016 and ANSI/ROHVA 1-2016 requirements for a minimum rollover resistance and a hang tag that displays the rollover resistance of each ROV may increase the lateral stability of ROVs and reduce the occurrence of rollovers.

2. Improving Vehicle Steering/Handling

Vehicle handling refers to the steering characteristic of the ROV, where the vehicle may exhibit understeer, neutral steer, and oversteer when the driver turns the steering wheel of the moving vehicle. Severe oversteer can lead to uncontrollable steering of the vehicle resulting in a sudden increase in the spinning motion of the ROV about its vertical axis (also known as "yaw") that is unstable and unpredictable. Yaw marks in an accident are associated with loss of control of a vehicle. ANSI/OPEI B71.9-2016 and ANSI/ROHVA 1-2016 rely on a constant steer angle test to define a vehicle handling performance requirement that prohibits oversteer that can lead to the uncontrollable steering and loss of control of the vehicle.

A constant-steer angle test is a method to measure a vehicle's steering characteristic. A human driver, or specialized test equipment, drives the vehicle on a specified circular path, and instrumentation on the vehicle measures the vehicle's angular velocity about its vertical axis (see Figure 2) to evaluate the vehicle's steering characteristic. ROHVA and OPEI call this test the "yaw rate test."

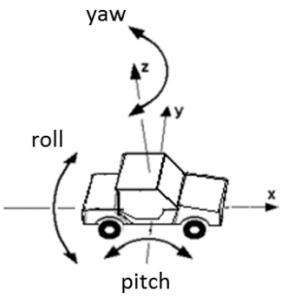

Figure 2. Vehicle axes.

Voluntary Standard Requirement for Vehicle Handling

Vehicle Handling. **ANSI/OPEI B71.9-2016 Section 8.8 and ANSI/ROHVA 1-2016 Section 10** each specify a method to: (1) measure and evaluate the extent of oversteer behavior in a vehicle; (2) identify vehicles that could exhibit uncontrollable steering; and (3) establish performance criteria that limit the amount of permissible oversteer. The vehicle handling requirements for ROVs use constant steer tests to compute a metric generally referred to as "yaw rate ratio," and the performance requirement is based on the values of the yaw rate ratios.

CPSC staff contracted SEA to conduct yaw rate tests of several ROVs at the Ackermann[9] angle for a 50-foot radius turn.[10] Test results showed that the yaw rate test is capable of detecting oversteer as a function of yaw rate increase, as shown in Figure 3. The slope of the yaw rate gain increase approaches infinity in a vehicle exhibiting uncontrollable steering, compared to linear yaw rate gain in a stable vehicle.

The test procedure requires five test runs in the right/clockwise and five test runs in the left/counter-clockwise directions, with instrumentation recording the vehicle speed, yaw rate, and steer angle. Plots of the vehicle's yaw rate versus speed are used to determine the pass/fail criteria for vehicle handling. The standards specify an equation for the yaw rate ratio based on the slopes of the yaw rate plots at the beginning and at the end of the yaw rate test.

$$R = \frac{(Y2/V2)}{(Y1/V1)}$$

Where:

Y2/V2 = Linear slope of yaw velocity versus time plot divided by linear slope of vehicle speed versus time plot in region between 0.4 and 0.5 g of lateral acceleration

Y1/V1 = Linear slope of yaw velocity versus time plot divided by linear slope of vehicle speed versus time plot in region between 0.1 and 0.2 g of lateral acceleration

The R values for the five test runs in the right/clockwise direction are averaged for the Final Slope Ratio Right, and the R values for the five test runs in the left/counter-clockwise are averaged for the Final Slope Ratio Left. The performance requirements state that no test shall result in two-wheel lift, and the R value in the left or right direction cannot exceed a value of 4.5.

CPSC Staff's Evaluation

CPSC staff's review and testing indicates that a vehicle steering/handling requirement that prohibits uncontrollable steering will reduce the occurrence of ROV rollovers caused by an ROV that has started to slide and rotate out of control. A tripped rollover occurs when a sliding vehicle impacts an object, such as a curb or a berm, causing the vehicle to roll over. An untripped rollover occurs when forces generated during a turn causes the vehicle to roll over. CPSC staff's research and testing shows that the sudden increase in lateral acceleration and yaw rate that is associated with uncontrollable steering can cause a sudden untripped rollover of a vehicle or can cause a vehicle to slide and experience tripped rollover.[11] Industry manufacturers have also stated

[9] Ackermann angle is the angle of the road-wheels required to turn the vehicle at any given turn radius when there are no steering deviations due to understeer or oversteer. To calculate the angle, use the equation: Ackermann Angle = arctangent (wheelbase/turn radius)

[10] Heydinger, G. et al. (2016). Yaw Rate Ratio Measurements of Recreational Off-Highway Vehicles Results from Constant Steer Angle Tests Conducted on 11 Vehicles. Retrieved from: https://cpsc.gov/s3fs-public/SEA-Final-Report-to-CPSC-Yaw-Rate-Ratio-Measurements-of-ROVs-June-2016.pdf?RvhhmK2KBiAL7bqOVQZXLCsSAKVYQnPi

[11] Letter from Caroleene Paul, CPSC, to Tom Yager, ROHVA, dated May 23, 2014. Retrieved at: http://www.cpsc.gov/Global/Regulations-Laws-and-Standards/Voluntary-Standards/ROHVA/052314signedCommentLettertoROHVACanvassDraft03032014.pdf.

that uncontrollable steering is hazardous because the vehicle is uncontrollable once the condition is reached, and a spinning vehicle poses a tripped rollover hazard.[12]

CPSC contracted SEA to conduct yaw rate tests, following the protocol specified in the voluntary standards, of several ROVs. Results of the yaw rate ratios for the vehicles tested by SEA using ROHVA and OPEI protocol are shown in Figure 3 below:

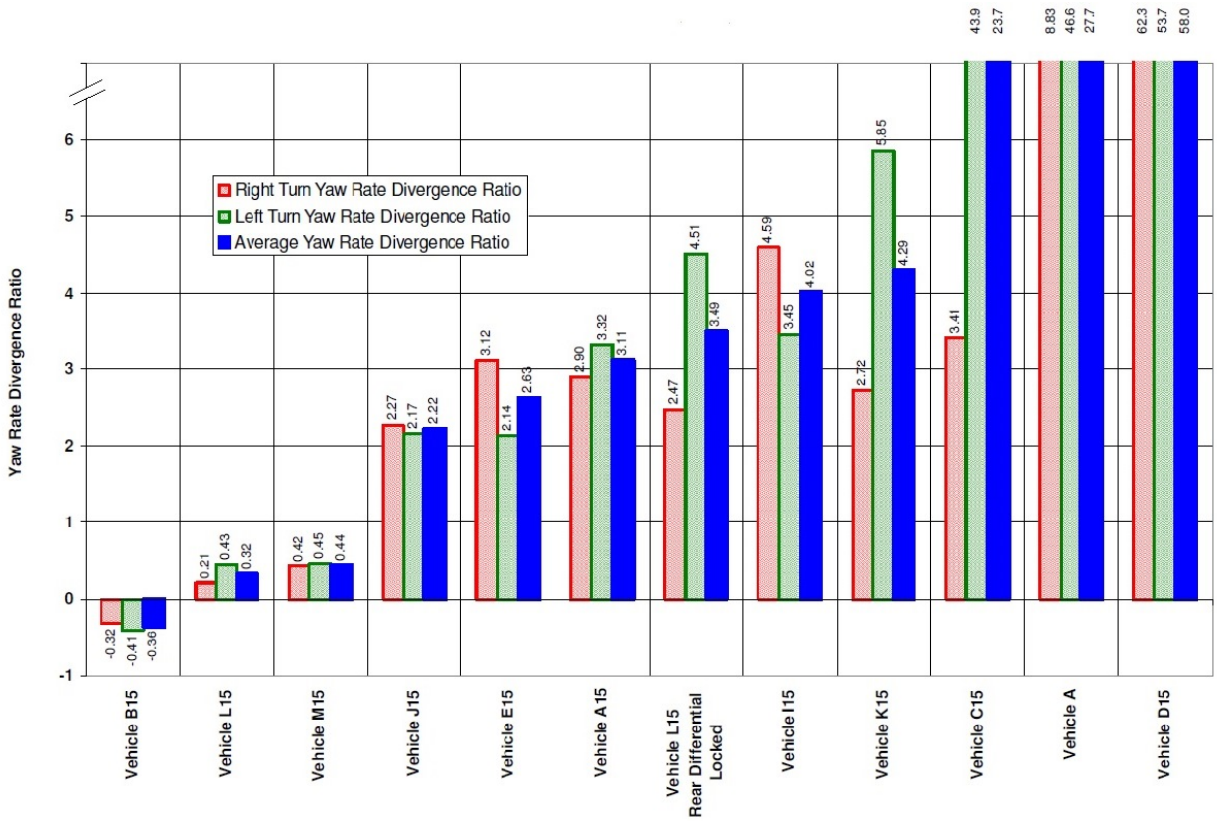

Figure 3. Yaw Rate Ratio Test Results from Baseline Tests on 11 Vehicles (Using OPEI and ROHVA test protocols).

Test results shown in Figure 3 show that lower R values are associated with vehicles that exhibit understeer, and higher R values are associated with vehicles that exhibit severe oversteer that can lead to uncontrollable steering. The vehicle handling requirement of an R value below 4.5 in the Left and Right directions eliminates vehicles that CPSC staff has identified as vehicles that exhibit uncontrollable steering. In addition, at a meeting on October 5, 2015, ROHVA representatives stated that manufacturers will design vehicles with an R value in the 3.5 range to meet a requirement of 4.5, due to reproducibility concerns and manufacturing margins and tolerances.[13] This means that the vehicles on the right side of Vehicle A15 shown in Figure 3 will need to be redesigned to have a Yaw Rate Ratio of about 3.5 or lower.

[12] Meeting log dated March 10, 2015. Uncontrollable steering is referred to as "divergent instability" in the meeting log. Retrieved from: https://cpsc.gov/s3fs-public/pdfs/blk_media_Meeting_Log_Polaris-dynamic_stability.pdf

[13] Meeting Log dated October 5, 2015. Retrieved from: http://www.cpsc.gov//Global/Newsroom/FOIA/Meeting%20Logs/2016/ROHVAPublicVoluntaryStandardsMeeting.pdf.

In summary, based on test results of model year 2014 and 2015 ROVs, staff concludes that the vehicle handling requirements in ANSI/ROHVA 1-2016 and ANSI/OPEI B71.9 -2016 will prohibit uncontrollable steering in ROVs, and thus, reduce injuries and deaths associated with ROV rollover events.

C. Addressing Occupant Ejection – Improving Occupant Protection

The data indicate that at least 80 percent of the reviewed investigations related to fatal ejections involved ejection of an unbelted occupant. In addition, staff identified 41 incidents in which a non-belted occupied died and a belted-occupant survived. This suggests improving the occupant protection performance of ROVs is a strategy for reducing the severity of injuries to occupants when ROVs do roll over. Increasing seat belt use is the primary method to improve occupant protection and additional factors, such as seat belt technology and passive side restraints, maximize the occupant protection provided by seat belts. Occupants who remain within the confines of the rollover protective structure (ROPS), often called a roll cage, of an ROV in a rollover event are less likely to be crushed by the vehicle. Therefore, the occupant protection requirements in ANSI/OPEI B71.9-2016 and ANSI/ROHVA 1-2016 standards should reduce the injury severity of ROV occupants when rollover events occur.

ANSI/ROHVA 1-2011 and ANSI/OPEI B71.9 include similar provisions to address occupant retention during a rollover event.

1. Increasing seat belt use

Voluntary Standard Requirement

ANSI/ROHVA 1-2016 Section 12.2 Seat Belt Reminder and Speed-limiter and **ANSI/OPEI B71.9-2016 Section 5.1.3.2 Seat Belt Reminder System** specify that ROVs shall be equipped with a reminder system that limits the vehicle's maximum speed to 15 mph, if the driver's seat belt is not buckled.

CPSC Staff's Evaluation

CPSC staff's review indicates that a requirement for a seat belt reminder tied to vehicle speed will reduce deaths and injuries associated with ROVs by increasing seat belt use and maximizing occupant protection during a rollover event. SEA roll simulator test results of several model year 2009-2011 ROVs and follow-up tests on several model year 2014-2015 ROVs show that seat belt use, in conjunction with robust passive shoulder restraint, prevents occupant ejection during tripped and untripped rollovers of ROVs. ROHVA also performed an analysis of hazard and risk issues associated with ROV-related incidents and determined that lack of seat belt use is the top incident factor. ROHVA stated in a letter dated April 18, 2011: "Based on the engineering judgment of its members and its review of ROV incident data provided by the CPSC, ROHVA

concludes that the vast majority of hazard patterns associated with ROV rollover would be eliminated through proper seat belt use alone." [14]

CPSC staff research shows that seat belt reminders that are annoying and persistent are the most effective method to increase seat belt use.[15] In particular, studies based on haptic feedback resistance showed almost 100 percent compliance when vehicle speed was tied to the seat belt reminder. Therefore, staff concludes that ROVs with a seat belt reminder that limits vehicle speed will be similarly effective.

Annex A of ANSI/ROHVA 1-2016 provides the rationale behind various requirements of the voluntary standard. The voluntary standard seat belt specification for only the driver's seat is based upon the principle that the ROV operator, in the role of "captain of the ship," is responsible for the safety of all vehicle occupants and will accordingly instruct passengers to use their seat belt. CPSC staff contracted Westat, Inc. (Westat) to conduct a survey of ROV seat belt use. Westat's report titled, "Observational Field Study of Seat Belt Use by Drivers and Passengers in Recreational Off-Highway Vehicles," showed the correlation between driver and passenger seat belt use is strong and statistically significant.[16] When the ROV driver was wearing a seat belt, the probability of the passenger wearing a seat belt was 94 percent.

Based on the SEA roll simulator tests showing the efficacy of seat belt use in keeping occupants inside an ROV during rollover, research that shows the efficacy of speed-limiting seat belt reminders, and the Westat observational report, which shows a strong correlation between driver and passenger seat belt use, staff believes that the ANSI/OPEI B71.9-2016 and ANSI/ROHVA 1-2016 requirement for a seat belt speed limiter that limits the vehicle speed to 15 mph if the driver's seat belt is not buckled will increase seat belt use in ROVs and reduce injuries and deaths caused by occupant ejection during ROV-related rollover events.

2. Improving seat belt performance

Voluntary Standard Requirement

ANSI/ROHVA 1-2016 Section 12.1 Seat Belts and **ANSI/OPEI B71.9-2016 Section 5.1.3.1 Seat Belts** specify that ROVs shall be equipped with a three-point seat belt that shall include an Emergency Locking Retractor (ELR) with a locking angle determined by the manufacturer based on the vehicle's intended use.

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[14] Yager, T. (2011) Letter to Caroleene Paul, dated April 18, 2011. Recreational Off-Highway Vehicle Association (ROHVA) written response to CPSC staff's ballot on proposed American National Standard ANSI/ROHVA 1-201X. p. 8. Retrieved from: https://cpsc.gov/s3fs-public/pdfs/blk_pdf_041811ROHVA1stBallotResponseLtrtoCPSConrevisiontovolstd.pdf

[15] See Tab I in Briefing Package Notice of Proposed Rulemaking (NPR) for Recreational Off-Highway Vehicles (ROVs) in *Safety Standard for Recreational Off-Highway Vehicles (ROVs)*. Retrieved from: https://cpsc.gov/s3fs-public/pdfs/foia_SafetyStandardforRecreationalOff-HighwayVehicles-ProposedRule.pdf.

[16] Jenness, J. et al. (2015). Observational Field Study of Seat Belt Use by Drivers and Passengers in Recreational Off-Highway Vehicles. Retrieved from: https://cpsc.gov/s3fs-public/WestatObservationalStudyReportROVSeatBeltUseTask3.pdf.

CPSC Staff's Evaluation

CPSC staff's review indicates that a requirement for seat belts with an ELR will reduce deaths and injuries associated with ROVs by maximizing occupant retention during a rollover event. CPSC staff contracted SEA to conduct dynamic occupant protection performance tests on several model year 2009-2011 ROVs and follow-up tests on several model year 2014-2015 ROVs.[17,18] SEA roll simulator testing showed that vehicles with tilt-sensing ELR performed better than vehicles without ELRs. Roll simulator testing of a vehicle with a non-ELR seat belt shows the seat-belted occupant's head coming out of the protective zone of the ROPS during a simulated roll over (see Figure 4).

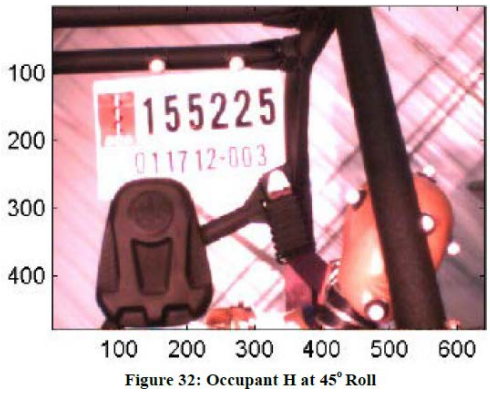


Figure 4. Occupant coming out of the ROPS zone during a simulated rollover. Seatbelt does not have a tilt-sensing ELR.

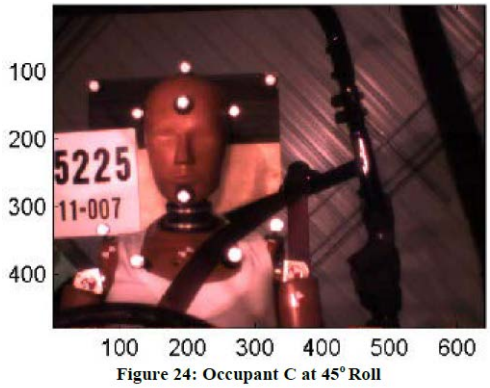


Figure 5. Occupant remaining in the ROPS zone during a simulated rollover. Seatbelt has a tilt-sensing ELR.

Conversely, roll simulator testing of a vehicle equipped with tilt-sensing ELR shows the occupant remaining in the protective zone of the ROPS during a simulated roll over (see Figure 5).

Based on SEA's roll simulator data, staff concludes that the ANSI/OPEI B71.9-2016 and ANSI/ROHVA 1-2016 requirement for seat belts with ELRs will improve occupant protection and reduce injury severity in ROV-related rollover events.

3. Improving side retention

Voluntary Standard Requirement

ANSI/ROHVA 1-2016 Section 12.3.1.2 Zone 2 Shoulder/Hip and **ANSI/OPEI B71.9-2012 Section 5.1.4 Occupant Side Retention Devices** specify similar requirements for a side barrier in the shoulder area for ROV occupants to increase occupant retention. Both voluntary standards define a point, R, that is located 17 inches above the seating surface and 6 inches forward of the

[17] Morr, D.R. (2012). Test and Evaluation of Recreational Off-Highway Vehicles (ROVs) Dynamic Occupant Protection Performance Tests. Retrieved from: https://cpsc.gov/s3fs-public/pdfs/ROVOccupantProtectionPerformanceTests.pdf.

[18] Zagorski, S. and Sidhu, A. (2016). Dynamic Occupant Protection Performance Tests for Recreational Off-Highway Vehicles (ROVs). Retrieved from: https://cpsc.gov/s3fs-public/SEADynamicOccupantProtection.pdf.

seat back. An outward sideways force of 163 lbf is applied through a 3-inch diameter disc probe at point R for 10 seconds. The performance requirement specifies that the side barrier shall not deflect more than 4 inches past the width of the vehicle after the force is applied.

CPSC Staff's Evaluation

CPSC staff's review indicates that a requirement for a passive shoulder barrier will reduce deaths and injuries associated with ROV rollover events by maximizing occupant retention during a rollover event. CPSC staff contracted SEA to conduct dynamic occupant protection performance tests on several model year 2014-2015 ROVs and to conduct side barrier tests in accordance with the requirements in ANSI/ROHVA 1-2016 and ANSI/OPEI B71.9-2016.[19] CPSC staff also conducted side barrier probe tests to confirm results of SEA probe tests.

The results of the dynamic occupant protection performance tests of model year 2014-2015 ROVs confirmed results of earlier tests of model year 2009-2011 ROVs[17] that showed best occupant protection performance in vehicles when seat belts are used in conjunction with a passive shoulder barrier restraint. CPSC staff considers the SEA dynamic occupant protection performance test as the best indicator of occupant excursion during a rollover event. Test results confirm that the ANSI/ROHVA 1-2016 and ANSI/OPEI B71.9-2016 side barrier performance tests eliminate vehicles that perform poorly in the dynamic occupant protection performance tests conducted by SEA.

Based on the SEA roll simulator tests showing the efficacy of seat belts used in conjunction with passive shoulder barrier restraints, and side barrier probe tests conducted by SEA and CPSC staff, staff concludes that the ANSI/OPEI B71.9-2016 and ANSI/ROHVA 1-2016 side barrier performance requirements will increase occupant protection performance and reduce injuries and deaths caused by occupant ejection during ROV-related rollover events.

D. Compliance with Voluntary Standards

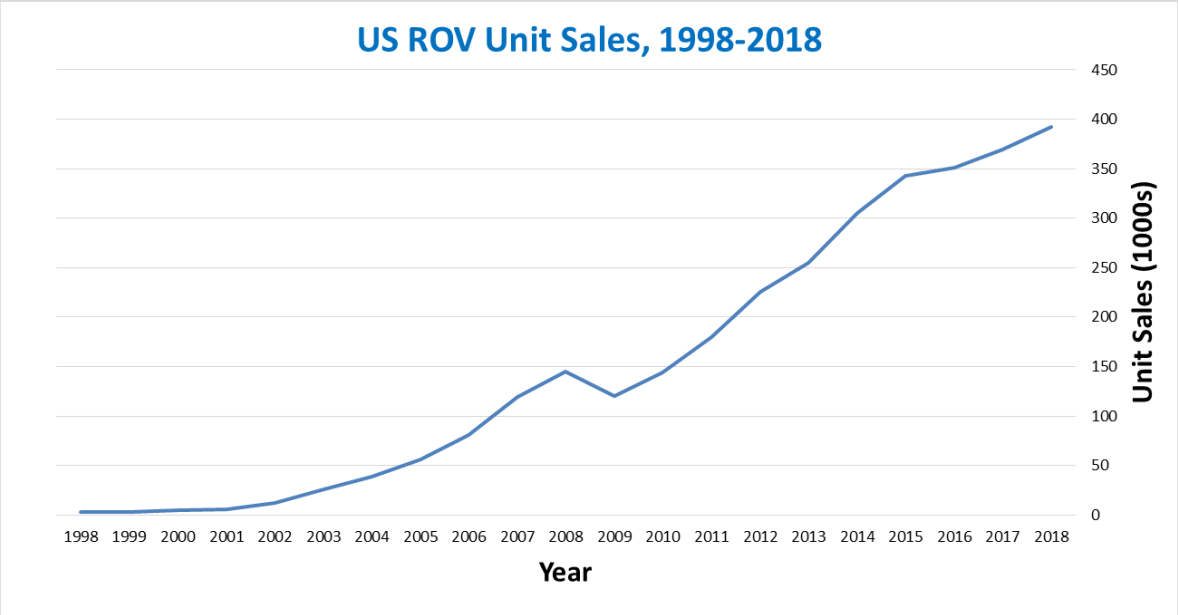
ROV Market

Currently, there are two general varieties of ROVs: utility and recreational (see Figure 6 and Figure 7). Models emphasizing utility have larger cargo beds, higher cargo capacities, and lower top speeds. Models emphasizing recreation have smaller cargo beds, lower cargo capacities, and higher top speeds. Utility and recreational ROVs have a maximum speed that exceeds 30 mph.

Figure 6. Typical Utility ROV

Figure 7. Typical Recreational ROV

Sales of ROVs have increased substantially since 1998. With the exception of 2009, annual sales have increased steadily from an estimated 2,700 units in 1998 to an estimated 392,000 units in 2018. The number of manufacturers marketing ROVs in the United States has also increased substantially in recent years. CPSC staff identified 38 manufacturers known to have supplied ROVs to the U.S. market in 2018, 23 from China (including Taiwan), 12 from the United States, and 1 each from Canada, Mexico, and South Korea. Just 7 such manufacturers were identified for the year 1998.[19] Annual ROV unit sales data for the period 1998 – 2018 are presented in Figure 8.

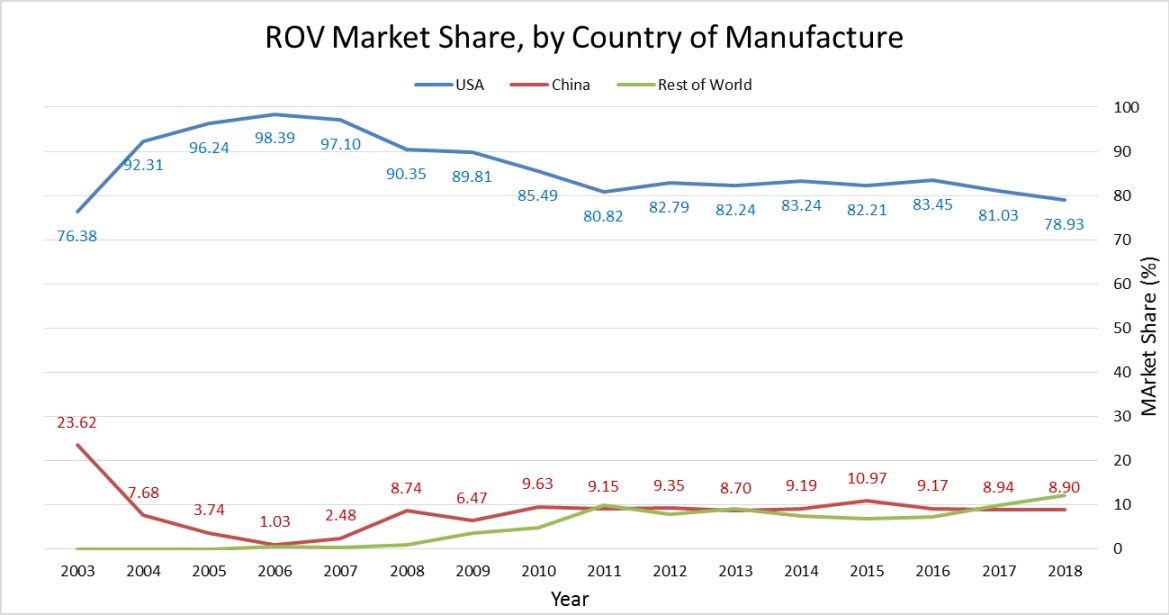


Source: CPSC staff analysis of sales data provided by Power Products Marketing, Eden Prairie, MN (2019).

Figure 8. ROV Sales (units) in the United States, 1998-2018

Despite the number of Chinese firms, North American manufacturers dominate the ROV market. In 2018, about 91 percent of ROV sold were manufactured in North America, 79 percent in the United States and 12 percent in Canada and Mexico combined. The remaining 9% were manufactured in Asia (primarily China). U.S. ROV market share increased from 76.38% in 2003, peaking at 98.39% in 2006, before declining to 80.82% in 2011. Since 2011, U.S. manufacturers' market share has remained within a relatively narrow range, reaching a local maximum of 83.45% in 2016 and local minimum of 78.93% in 2018. Market shares of U.S., China, and rest of world manufacturers for years 2003 to 2018 are presented in Figure 9.

[19] This information is based upon a staff analysis of 1998 – 2018 sales data provided by Power Products Marketing, Eden Prairie, MN (2019).



Source: CPSC staff analysis of sales data provided by Power Products Marketing, Eden Prairie, MN (2019).

Figure 9. ROV Market Share, by Country of Manufacture, 2003-2018

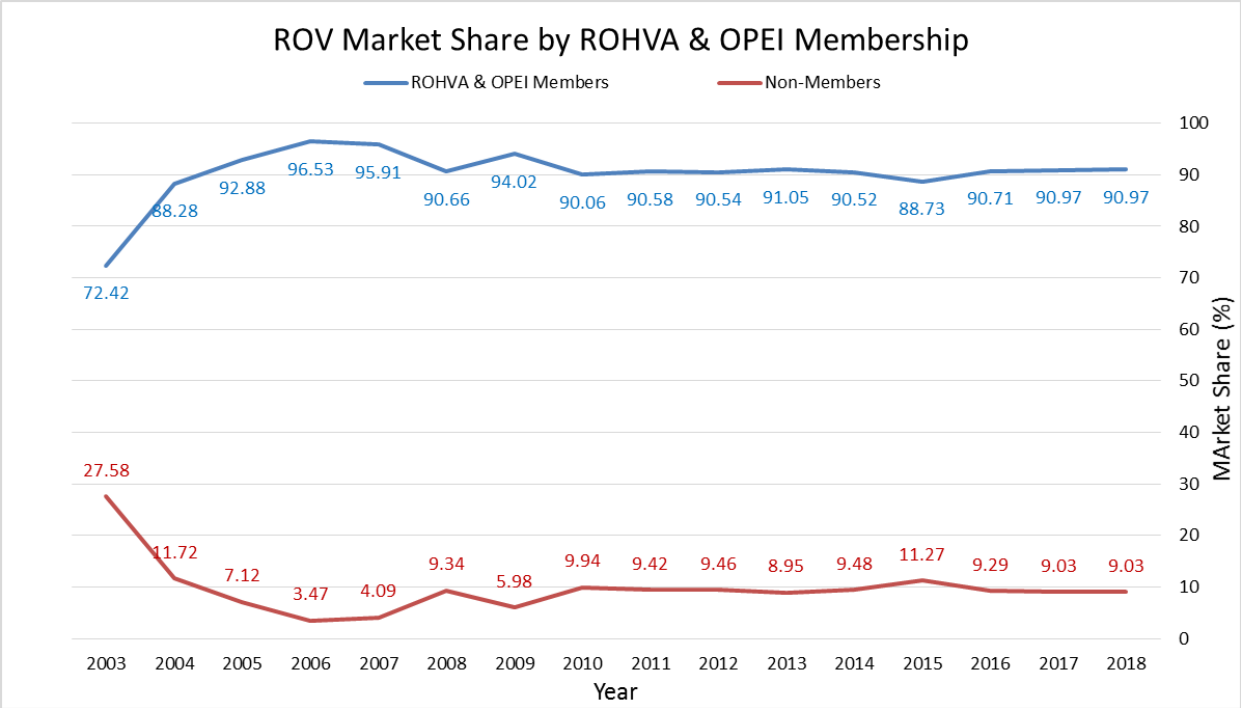
ROV Market Compliance

ROHVA developed ANSI/ROHVA 1 *American National Standard for Recreational Off-Highway Vehicles* and covers both recreation-oriented ROVs and ROVs that have utility applications. ROHVA member companies include Can-Am/BRP, Honda, Kawasaki, Mahindra, Polaris, Textron/Artic Cat, and Yamaha.[20] OPEI developed ANSI/OPEI B71.9, *American National Standard for Multipurpose Off-Highway Utility Vehicles* primarily for utility-oriented ROVs. OPEI member ROV manufacturers include Cub Cadet (MTD), Excel, John Deere, and Kubota as well as several manufacturers that are also members of ROHVA (Honda, Kawasaki, Mahindra, Polaris, Textron, and Yamaha).[21]

ANSI/OPEI B71.9-2016 states that the "effective implementation date of this standard shall be two (2) years after the publication date and shall apply to all products built after that date. Manufacturers may also comply with this standard any time after [August 2, 2016]." ANSI/ROHVA 1-2016 states that the standard "becomes effective beginning with 2018 model year vehicles, but earlier compliance is permitted." Given their active participation in developing these standards, and subsequent statements by ROHVA and OPEI, and by OPEI member John Deere, Inc., CPSC staff believes all ROVs manufactured by ROHVA and OPEI members for model years 2018 and later comply with the voluntary standards.[22]

[20] ROHVA website retrieved from: http://www.rohva.org/.
[21] OPEI website retrieved from: https://www.opei.org/.
[22] In a letter dated July 22, 2020, ROHVA confirmed "member manufacturers and distributors of ROVs are required to equip all ROVs for sale in the United States with a label certifying that the product complies with ANSI/ROVHA 1-2016," and that "ROHVA has been informed by its members that each of their ROVs subject to the ANSI/ROHVA standard displays this certification label." In a letter dated August 24, 2020, OPEI states member organizations American Honda Motor Company., Inc. Deere & Company, Kawasaki Motors Corp., U.S.A, Kubota

Manufacturers belonging to ROHVA and/or OPEI accounted for about 91 percent of 2018 U.S. ROV sales; ROHVA members alone accounted for 81 percent. Four non-member North American manufacturers, in combination with overseas manufacturers, all of which are non-members, accounted for the remaining 9 percent of the U.S. ROV market. These market shares have remained relatively stable since 2008. Therefore, with the expectation that all current ROHVA and OPEI members will continue to comply with ANSI/ROHVA 1-2016 and/or ANSI/OPEI B71.9-2016, CPSC staff believe that, beginning with the 2018 model year, at least 90 percent of ROVs sold in the United States will comply with the voluntary standards. It is also possible some non-members will incorporate ANSI recommended changes so as to be competitive with respect to safety, which suggests compliance with the voluntary standards could exceed 90 percent. With a 90 percent compliance rate, about 357,000 of the estimated 392,000 ROVs supplied to the United States market in 2018 complied with the voluntary standard. Assuming a 5.5 percent annual growth rate in ROV unit sales (the average annual growth rate over 2016-2018), the estimated number of ROVs in use which would comply with the voluntary standard would have increased to about 734,000 in 2019 and to about 1,131,000 by the end of 2020. Market shares of ROHVA and OPEI manufacturers for years 2003 to 2018 are presented in Figure 10.



Source: CPSC staff analysis of sales data provided by Power Products Marketing, Eden Prairie, MN (2019).

Figure 10. ROV Market Share by ROHVA and OPEI Membership, 2003-2018

Tractor Corporation, MTD Products, Polaris, and Textron Specialized Vehicles "have confirmed that each of their products within the scope of OPEI B71.9-2016 or ROHVA-1-2016 (as determined by each manufacturer) displays the required label stating that vehicles complies with the standard." Manufacturers covered by these statements accounted for over 99% of ROHVA and OPEI member ROV sales and over 90% of all U.S. ROV sales in 2018.

In summary, CPSC staff believes that at least 90 percent of ROVs sold in the United States comply with the ANSI/ROHVA 1-2016 and/or ANSI/OPEI B71.9-2016. Staff also anticipates future compliance rates will remain at about 90 percent. Further, this 90 percent estimate may be low as it assumes no non-member manufacturers will comply with the voluntary standards. We caution that these conclusions are based upon statements from trade associations that their members are complying and materials from a few manufacturers claiming compliance. These statements have not been confirmed through CPSC testing of the vehicles.

E. Retrospective Review of Voluntary Standards

In 2016, the Commission voted to adopt a motion to direct staff to conduct a retrospective review of ANSI/ROHVA 1-2016 and ANSI/OPEI B71.9-2016 no later than two years after the effective dates and assess the effectiveness of the standards. Specifically, the motion states "at a time no later than two years after the effective dates of the standards, [staff] will assess and report to the Commission on the effectiveness of the standards, including:

1. whether the provisions in the voluntary standards on Lateral Stability, Vehicle Handling, and Occupant Protection have eliminated or adequately reduced the risk of ROV rollover and occupant ejection based on incident data,
2. whether the provisions in the voluntary standards on Lateral Stability, Vehicle Handling, and Occupant Protection have been substantially complied with,
3. whether the provisions in the voluntary standards on Lateral Stability, Vehicle Handling, and Occupant Protection need to be made more stringent in order to provide necessary protection for consumers,
4. whether safety standards to address any new risks not addressed in the above standards are needed to further protect consumers"

To conduct its retrospective review, staff used the 846 completed IDIs of reported incidents from 2012 to 2019 to confirm that ROV rollover and occupant ejection are primary hazards that can be addressed by voluntary standards requirements on lateral stability, vehicle handling, and occupant protection. When possible, staff also determined the model year of the ROV involved in each IDI by its vehicle identification number (VIN), which was often provided in police reports, or by markings on the frame which were visible in photographs provided in the IDIs. All "incidents" referred to hereafter are a subset of the 846 successfully completed IDIs.

Lateral stability and Vehicle Handling Requirements (address ROV rollover hazard)

As noted before, staff identified 333 IDIs involving vehicle rollover in a turn, and 71 of those incidents occurred from September 2017 to December 2019 (the time-frame when MY 2018 vehicles that comply with the lateral stability and vehicle handling requirements in the voluntary standards were introduced to the ROV market). Staff identified two incidents which involved MY 2018 ROV that may have complied with the current voluntary standard requirements for vehicle stability (hang tag with maximum tilt table angle) and voluntary standard requirements for vehicle handling (controllable steering). No incidents involving rollover in a turn were identified as involving a MY 2019 or newer ROV, however incident data for the last 2 years are incomplete and likely to increase as reports are provided to the CPSC.

As noted above, with a 90 percent compliance rate, about 357,000 of the estimated 392,000 ROVs supplied to the United States market in 2018 complied with the voluntary standards. Assuming a 5.5 percent annual growth rate in ROV unit sales (the average annual growth rate over 2016-2018), the estimated number of ROVs in use that complied with all requirements in the current voluntary standard would have increased to about 734,000 in 2019 and to about 1,131,000 by the end of 2020. We cannot say what proportion of the ROVs in use comply with the voluntary standard because we do not have good information on the useful product life of ROVs. However, given the 3,180,000 ROVs that have been sold between 2003 and 2018, we can say that at least 11 percent of ROVs in use in 2018 conformed to the standard, and, given our projections, at least 20 percent would have conformed by 2019, and 27 percent would have conformed by 2020.

Overall, however, given that the incidents reviewed do not constitute a statistically-derived sample of ROV-related incidents, and staff has no exposure data with which to compare, staff is unable to relate these incidents to an assessment of effectiveness of the voluntary standard.

Occupant Protection Requirements (address occupant ejection hazard)

Requirements for locking seat belts, passive shoulder restraint, and seat belt speed limiter

Staff was able to determine the model year for ROVs in 468 of the 637 IDIs involving fatal ejection of one or more occupants; of those 468 incidents, staff identified 147 incidents involving ejection that occurred from September 2017 to December 2019, and staff identified 8 incidents which involved ROVs (six MY 2018 vehicles and two MY 2019 vehicles) that may have complied with all the occupant protection requirements (seat belt speed limiter, side retention barriers, and locking seat belts) of the current voluntary standards. Of those 8 incidents: 1 involved an occupant in the bed of the ROV, 2 involved the driver, and 5 involved passengers (4 of whom were not wearing seat belts, plus 1 unknown).

Seat belt speed limiters

Staff is aware that one manufacturer has incorporated seat belt speed limiters since they introduced an ROV in 2010, and in August 2014, another manufacturer stated that its MY 2015 and later ROVs would incorporate the technology.[23] From the 637 IDIs involving fatal ejection, staff identified the following:

- 78 incidents involving vehicles determined as MY 2015 and later by the manufacturer who announced its vehicles would incorporate seat belt speed limiters
- 38 incidents involving vehicles manufactured by the manufacturer that introduced seat belt speed limiters in 2010
- 2 incidents involving My 2018 vehicles by two other manufacturers
- 5 incidents involving "unknown" model year vehicles in which the seat belt speed limiter was bypassed by buckling the seat belt behind the driver.

[23] Retrieved at: http://www.weeklytimesnow.com.au/machine/sidebyside-vehicles-soon-to-get-safety-improvements/story-fnkerd6b-1227023275396.

In total, 123 of the 637 IDIs involving fatal ejection (19 percent) involved a vehicle that was most likely equipped with seat belt speed limiters in the driver's seat. Of those 123 incidents:

- 14 incidents involved bypass of the seat belt by the fatal occupant
  - 11 incidents involved bypass of seat belt by the driver
    - In 2 incidents the passenger also bypassed the seat belt and was not fatally injured
    - 1 incident involved electrical bypass of the speed limiter to accommodate a 5-point harness (which the driver failed to wear)
  - 3 incidents involved bypass of the seat belt by the front passenger
    - In all 3 cases, the driver also bypassed the seat belt and was not fatally injured
- 10 incidents involved fatal ejection of an occupant who was not located in an area of the vehicle with a seat belt
- In 81 incidents the fatal occupants were reportedly not wearing a seat belt, with no further information available on why not and whether seat belt limiters were in operation
  - In 46 incidents the fatal occupant was the driver
  - In 35 incidents the fatal occupant(s) was the passenger
- Of the remaining 18 incidents, in 4 incidents the fatal occupant was wearing a seat belt and still ejected (most often because the occupant seat completely separated from the vehicle in a high energy rollover) and in 14 incidents the fatal occupant's seat belt use was unknown.

Based on sales data of ROVs equipped with seat belt speed limiters sold in the U.S. market, the percentage of ROVs with seat belt speed limiters in 2018 is 88.82 percent, as presented in Figure 11.

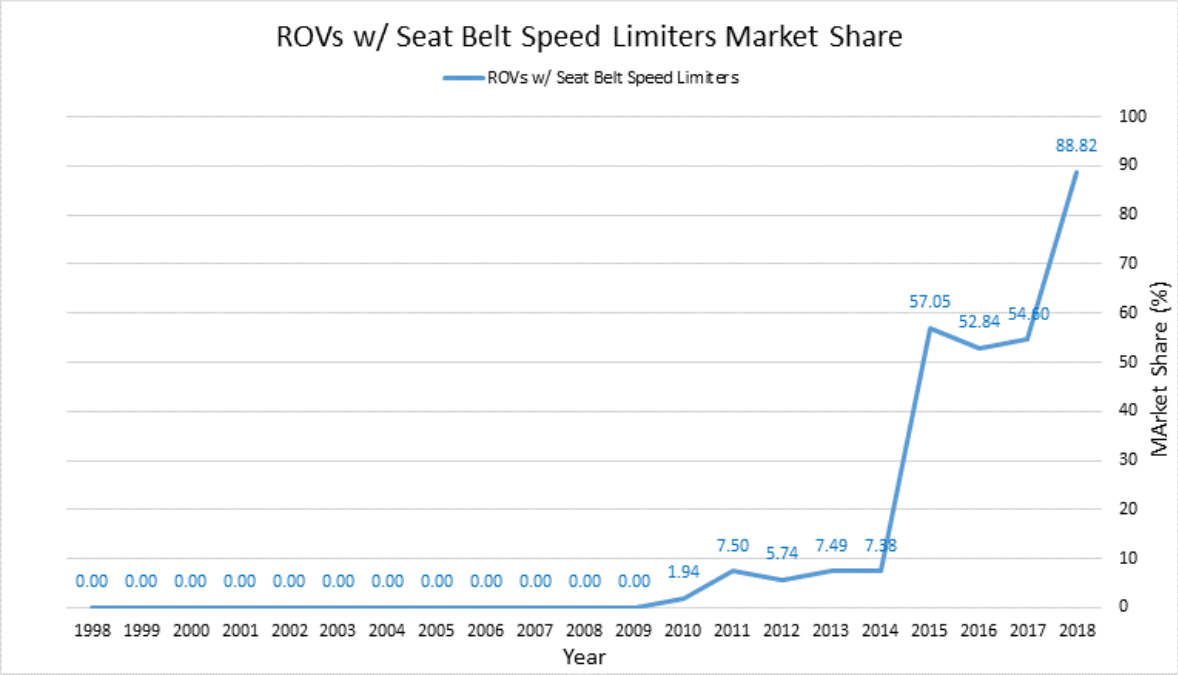


Figure 11. ROVs with seat belt speed limiters.

Given that the incidents reviewed do not constitute a statistically-derived sample of ROV-related incidents, and staff has no exposure data with which to compare, staff is unable to relate these incidents to an assessment of effectiveness of the voluntary standard. This is particularly important as vehicles that comply with the recently changed voluntary standard are still a subset of all vehicles in operation.

CPSC staff believes that at least 90 percent of ROVs sold in the United States comply with the ANSI/ROHVA 1-2016 and/or ANSI/OPEI B71.9-2016 standards, and staff also anticipates future compliance rates will remain at about 90 percent. Therefore, the proportion of all vehicles in operation that comply with the voluntary standards will continue to grow.

Based on staff's assessment of the voluntary standards, and expected saturation of the vehicle population with complyimg vehicles, CPSC staff do not believe the provisions in the voluntary standards on Lateral Stability, Vehicle Handling, and Occupant Protection need to be made more stringent in order to provide necessary protections for consumers.

CPSC staff do believe the standard needs to be updated to address thermal and debris penetration risks not addressed in the current standard and are actively engaged with the standards organization to address these hazards.

III. CONCLUSION

Based on the incident data, CPSC staff concludes that, to reduce deaths and injuries associated with ROVs, ROV rollover and occupant ejection are primary hazards that need to be addressed. Improving the lateral rollover resistance and vehicle steering/handling characteristics of ROVs is a strategy for reducing the occurrence of ROV rollover events. Increasing occupant protection performance of ROVs is a strategy to protect ROV users when rollover events occur.

In June 2016, ROHVA and OPEI revised their respective voluntary standards to increase the lateral stability of ROVs, to prohibit oversteer vehicle handling that can lead to uncontrollable steering, and to increase occupant retention within the protective zone of the ROPS of the vehicle during a rollover event. CPSC staff believes that ROVs that meet ANSI/ROHVA 1-2016 and ANSI/OPEI B71.9-2016 will exhibit reasonable lateral stability and steering/handling characteristics for an off-road vehicle while maintaining performance characteristics necessary to operate on off-road terrain. In addition, staff believes the revised standards are likely to reduce the occurrence of occupant ejection during rollover events by increasing seat belt use and improving side retention. Therefore, staff concludes the current voluntary standards will adequately address the risk of ROV rollover and occupant ejection.

CPSC staff estimates that current ROHVA and OPEI members make up over 90 percent of the ROV market. Staff believes that these members comply with ANSI/ROHVA 1-2016 and/or ANSI/OPEI B71.9-2016, and that at least 90 percent of future ROVs sold in the United States will comply with the voluntary standards. It is also possible some non-members will incorporate ANSI recommended changes so as to be competitive with respect to safety, which suggests compliance with the voluntary standards could exceed 90 percent.

For these reasons, staff recommends that the Commission terminate the rulemaking on ROVs, at 79 FR 68964 (November 19, 2014).