Memorandum

Date: SEP 28 2005

TO	:	The Commission
		Todd Stevenson, Secretary
THROUGH:		Page Faulk, General Counsel
		Patricia M. Semple, Executive Director
FROM	:	Jacqueline Elder, Assistant Executive Director
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SUBJECT	:	2004 Annual Report of All-Terrain Vehicle (ATV)-Related Deaths and Injuries

Attached is the annual report of ATV-related deaths and injuries for the year 2004. This report covers death data available as of December 31, 2004 and data on injuries occurring up to December 31, 2004.

Attachment (1)

NOTE: This document has not been reviewed or accepted by the Commission.
Initial _____ Date _____

2004 Annual Report of ATV Deaths and Injuries

September 2005

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NOTE: This document has not been
reviewed or accepted by the Commission.
Initial _____ Date _9/28/05_

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Introduction

U.S. Consumer Product Safety Commission (CPSC) staff first began analyzing data on all-terrain vehicles (ATVs) in the early 1980s as a means to provide statistics on the numbers of deaths and injuries associated with three-wheel ATVs. In April of 1988, CPSC entered into consent decrees with five ATV distributors in which the they agreed, among other things, to halt production of three-wheelers, offer safety training to all new ATV owners, and recommend adult-sized ATVs only for those aged 16 and older. Those decrees expired in April of 1998. Following their expiration, the five distributors and two others have agreed to continue most of the elements of the consent decrees through voluntary action plans. Most of the vehicles on the market today are four-wheel ATVs, though some of the three-wheelers survive in use by consumers.

This report provides an update of CPSC data on ATV deaths and injuries. This update includes death reports available as of December 31, 2004 and data on injuries occurring up to December 31, 2004.

Deaths Reported to the Commission

On December 31, 2004, the Commission had reports of 6,494 ATV-related deaths that have occurred since 1982 (Table 1). The number of new reports increased by 703 since the December 31, 2003 tabulation reported by Commission staff on January 1, 2005. The new reports include deaths occurring over the period 2000 to 2004 inclusive. While collection of death reports for 2000 and 2001 is substantially complete (but may not be fully complete), data collection for 2002 through 2004 is ongoing. Consequently, the numbers of reported deaths for 2002 through 2004 are expected to rise before the next annual report. The numbers of reported deaths for 2000 and 2001 may rise only very slightly.

Values above the heavy line in Table 1 reflect a revised classification system from the one used prior to 1999. Specifically, the line marks the switch from data collection under the Ninth Revision of the International Classification of Diseases (ICD-9) to collection under the Tenth Revision (ICD-10), a transition that occurred worldwide in January of 1999. Any comparison of numbers above and below the line should be undertaken with caution. The ICD-10 transition and related methodological issues are discussed more fully in Appendix B.

Table 2 gives the numbers of reported ATV-related deaths for each state, the District of Columbia and Puerto Rico. Deaths occurring in the period 1982 through 2001 are tabulated in the second column and allow for the comparable ranking of states. The years 1982 to 2001 constitute the period for which death report collection is substantially complete. The highest numbers of deaths occurring in the complete period were for California (297 deaths), Pennsylvania (273), Texas (221), Michigan (210), and New York (207). Together these five states accounted for 25 percent of all reported deaths in the U.S., as shown in column three.

Counts of deaths reported as of December 31, 2004 in each state for the period 2002-2004 are tabulated in the fourth column of Table 2. This tabulation of deaths reported in these years cannot be used for comparisons among states because data collection in some states is more complete than in other states for those years. Each state's total number of reported deaths is listed in the fifth column.

Table 1
Reported ATV-Related Deaths by Year
ATVs with 3, 4 or Unknown Number of Wheels
January 1, 1982 to December 31, 2004

Year[1]	Number of Deaths	Difference Since Last Update (12/31/2003)
Total	**6,494**	**+703**
2004	*470*	*+470*
2003	*569*	*+162*
2002	*532*	*+59*
2001	505	+11
2000	449	+1
1999[2]	399	0
1998	251	0
1997	241	0
1996	248	0
1995	200	0
1994	198	0
1993	183	0
1992	221	0
1991	230	0
1990	234	0
1989	230	0
1988	250	0
1987	264	0
1986	299	0
1985	251	0
1984	156	0
1983	85	0
1982	29	0

Source: U.S. Consumer Product Safety Commission, Directorate for Epidemiology, Division of Hazard Analysis. Italics denote the period for which reporting is incomplete.

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[1] Reporting is incomplete for 2002-2004. Reporting for 2000 and 2001 is substantially complete, but future death reports for these years may result in slight differences in Tables 1 through 4.

[2] Beginning in 1999, deaths were coded under the Tenth Revision of the International Classification of Diseases (ICD-10). See Appendix B for an explanation of the effect of this change.

Table 2
Deaths Associated With ATVs by State
ATVs with 3, 4 or Unknown Number of Wheels
Reported for the Period January 1, 1982 Through December 31, 2004

State	Reported Deaths 1982-2001	Cumulative Percent of U.S. 1982-2001	Reported Deaths 2002-2004*	Total Reported Deaths*
CALIFORNIA	297	6%	50	347
PENNSYLVANIA	273	12	84	357
TEXAS	221	16	49	270
MICHIGAN	210	20	52	262
NEW YORK	207	25	49	256
WEST VIRGINIA	197	29	93	290
TENNESSEE	189	32	58	247
FLORIDA	185	36	72	257
KENTUCKY	182	40	106	288
NORTH CAROLINA	170	43	77	247
ARKANSAS	160	47	16	176
MISSISSIPPI	156	50	36	192
GEORGIA	148	53	56	204
WISCONSIN	140	56	38	178
MINNESOTA	135	58	43	178
OHIO	134	61	52	186
MISSOURI	133	64	46	179
ALABAMA	116	66	29	145
LOUISIANA	114	68	31	145
ARIZONA	108	71	37	145
ILLINOIS	108	73	30	138
UTAH	90	75	23	113
VIRGINIA	89	76	34	123
INDIANA	85	78	33	118
ALASKA	84	80	14	98
OREGON	82	82	27	109
OKLAHOMA	70	83	24	94
MAINE	66	84	22	88
IOWA	65	86	21	86
KANSAS	65	87	20	85
IDAHO	57	88	26	83
COLORADO	54	89	23	77
NEW MEXICO	50	90	19	69
WASHINGTON	49	91	19	68
SOUTH CAROLINA	46	92	29	75
NEBRASKA	46	93	11	57
MASSACHUSETTS	41	94	14	55
NEW HAMPSHIRE	37	95	13	50
NEW JERSEY	36	95	12	48
VERMONT	36	96	6	42
NEVADA	32	97	13	45
MARYLAND	29	97	16	45
SOUTH DAKOTA	29	98	5	34
NORTH DAKOTA	27	98	5	32
MONTANA	26	99	15	41
CONNECTICUT	18	99	8	26
WYOMING	15	100	8	23
DELAWARE	5	100	1	6
HAWAII	3	100	4	7
RHODE ISLAND	3	100	2	5
DISTRICT OF COLUMBIA	3	100	0	3
PUERTO RICO	2	100	0	2

Source: U.S. Consumer Product Safety Commission, Directorate for Epidemiology, Division of Hazard Analysis.
Italics denote the period for which reporting is incomplete.
*Data collection for 2002-2004 is incomplete. Columns 4 and 5 should not be used for comparison among states.

Characteristics of ATVs and Fatalities

A review of the reported fatalities indicated that 2,019 victims (31 percent of the 6,494 total) were under 16 years of age and 845 (13 percent of the total) were under 12 years of age. Table 3 gives the numbers and percentages of reported fatalities by year for the 0- to 15-year-old age group. Appendix A contains a more detailed breakdown of numbers of reported deaths in this age group.

Table 3
Reported ATV-Related Deaths of Children Under 16 Years Old
ATVs with 3, 4 or Unknown Number of Wheels
January 1, 1982 to December 31, 2004

Year[3]	0-15 Years Old	0-15 Years Old Percent of Total
Total	**2,019**	**31%**
2004	*130*	28
2003	*140*	25
2002	*133*	25
2001	130	26
2000	124	28
1999[4]	90	23
1998	82	33
1997	79	33
1996	87	35
1995	64	32
1994	54	27
1993	59	32
1992	71	32
1991	68	30
1990	81	35
1982-1989	627	40

Source: U.S. Consumer Product Safety Commission, Directorate for Epidemiology, Division of Hazard Analysis.
Italics denote the period for which reporting is incomplete.

While the percentage of victims under age 16 appears to have declined since 1998, it is more probable that adult deaths were under-reported during the period 1982 to 1998. Because of coding issues associated with ATV-related fatalities under the old ICD-9 system, CPSC was less able to gather reports of deaths on public roads during those years. If adults were more likely to use ATVs on public roads than children were during that time frame, then deaths of children may appear to have been over-reported. See Appendix B for more discussion of this effect.

Production of three-wheel ATVs ceased in the mid- to late-1980s, and all ATVs currently distributed in the U.S. are four-wheel ATVs. The percent of reported fatalities that involved four-wheel ATVs has

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[3] Reporting is incomplete for 2002-2004. Percentages for years for which reporting is incomplete should be interpreted with caution because the rate at which deaths are reported may not be consistent across all age groups.
[4] Beginning in 1999, deaths were coded under the Tenth Revision of the International Classification of Diseases (ICD-10). See Appendix B for a discussion of the effect of this change.

increased from seven percent or less prior to 1985 to about 90 percent during the 2000s, based on those fatalities reported as of December 31, 2004 (at which time data collection for 2002-2004 was not complete).

Estimated Deaths and Risk of Death, 1985 to 2003

The deaths reported to the Commission represent a minimum count of ATV-related deaths. To account for deaths not reported to the Commission, estimates of the annual deaths were calculated for 1985 through 2003 using a statistical estimation method. Table 4 shows the annual reported and estimated numbers of ATV-related deaths for ATVs with three, four or unknown number of wheels, in addition to the annual estimates and risk of death for four-wheel ATVs (per 10,000 in use) from 1985 to 2003.

Table 4
Annual Estimates of ATV-Related Deaths
And Risk of Death for Four-Wheel ATVs
As of December 31, 2004

Year	Reported Deaths[5]	Estimated Deaths Associated With ATVs with 3, 4 or Unknown Wheels	Estimated Deaths Involving 4-Wheel ATVs	Estimated 4-Wheel ATVs in Use (millions)[6]	Estimated Risk of Death per 10,000 4-Wheel ATVs In Use
2003	*569*	*740*	*703*	*6.2*	*1.1*
2002	*532*	*617*	*578*	*5.5*	*1.0*
2001	505	599	553	4.9	1.1
2000	449	553	502	4.2	1.2
1999[7]	399	538	490	3.6	1.4
1998	251	287	245	3.1	0.8
1997	241	291	243	2.7	0.9
1996	248	267	208	2.4	0.9
1995	200	276	212	2.2	1.0
1994	198	244	168	2.0	0.8
1993	183	211	144	1.9	0.7
1992	221	241	158	1.9	0.8
1991	230	255	152	1.8	0.8
1990	234	250	151	1.8	0.9
1989	230	258	153	1.6	0.9
1988	250	286	152	1.4	1.1
1987	264	282	126	1.1	1.1
1986	299	347	95	0.7	1.3
1985	251	295	55	0.4	1.5

Source: U.S. Consumer Product Safety Commission, Directorate for Epidemiology, Division of Hazard Analysis.
Italics denote the period for which reporting is incomplete.

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[5] Reporting is incomplete for 2002-2004.
[6] Rounded.
[7] Beginning in 1999, deaths were coded under the Tenth Revision of the International Classification of Diseases (ICD-10). See Appendix B for an explanation of the effect of this change.

The heavy line between 1998 and 1999 in Table 4 demarcates the previously discussed switch from data collection under ICD-9 to ICD-10. The ICD-10 transition and the resulting necessary changes in methodology are explained more fully in Appendix B. Because ICD-10 allows CPSC to gather data on more ATV-related deaths on public roads than had been possible under ICD-9, some of the increase in deaths from 1998 to 1999 is probably due to changes in data collection, although the magnitude of the effect of this change is unclear. Such a conclusion would indicate that the death and risk estimates calculated by the pre-1999 methodology were underestimates, though they were the best estimates possible using available data.

Column 5 of Table 4 gives annual estimates for the numbers of four-wheel ATVs in use. According to CPSC staff's *All Terrain Vehicle 2001 Injury and Exposure Studies*, in 2001, about 5.6 million three- and four-wheel ATVs were in use, and about 86 percent of these were four-wheelers (Levenson, 2003a).

A discussion of the methodology used for the calculation of the estimates of the numbers of deaths and the risk of death associated with ATVs is given in Appendix B.

Estimated Hospital Emergency-Room-Treated Injuries

Table 5 shows estimates of ATV-related injuries treated in hospital emergency rooms nationwide between January 1, 1982 and December 31, 2004. These estimates are generated from CPSC's National Electronic Injury Surveillance System, a probability sample of U.S. hospitals with 24-hour emergency rooms and more than six beds. In this analysis, the current estimates are compared to the estimates from the immediately previous year, as well as to a base year. The base year chosen for comparison was 1998. The existence of a trend in injuries associated with ATVs with three, four or an unknown number of wheels is also considered.

The injury estimate for all ages for 2004 reflects an increase of about eight percent over the 2003 estimate. This increase was not statistically significant (p = 0.1178). However, the increase of 101 percent over the estimated number of injuries in 1998 is a statistically significant increase (p < 0.0001).

The 2004 estimate for children under 16 represents a 16 percent increase over the 2003 estimate. This increase was statistically significant (p = 0.0457). The 2004 under-16 estimate is a 78 percent increase over the 1998 estimate. This increase was also statistically significant (p < 0.0001).

Children under 16 years of age accounted for about 33 percent of the estimated number of injuries in 2004. Historically, children under 16 have accounted for about 37 percent of the total estimated number of injuries from 1985 through 2004 inclusive.

Table 5
Annual Estimates[8] of ATV-related Emergency-Room-Treated Injuries
ATVs with 3, 4 or Unknown Number of Wheels
January 1, 1982 through December 31, 2004

Year	Estimated Number of Injuries All Ages	Estimated Number of Injuries Ages Less Than 16 Years	Percent of Total Ages Less Than 16 Years
2004	136,100	44,700	33%
2003	125,500	38,600	31
2002	113,900	37,100	33
2001	110,100	34,300	31
2000	92,200	32,000	35
1999	82,000	27,700	34
1998	67,800	25,100	37
1997	52,800	20,600	39
1996	53,600	20,200	38
1995	52,200	19,300	37
1994	50,800	21,400	42
1993	49,800	17,900	36
1992	58,200	22,000	38
1991	58,100	22,500	39
1990	59,500	22,400	38
1989	70,300	25,700	37
1988	74,600	28,500	38
1987	93,600	38,600	41
1986	106,000	47,600	45
1985	105,700	42,700	40
1984	77,900	9	
1983	32,100	9	
1982	10,100	9	

Source: National Electronic Injury Surveillance System, U.S. Consumer Product Safety Commission.
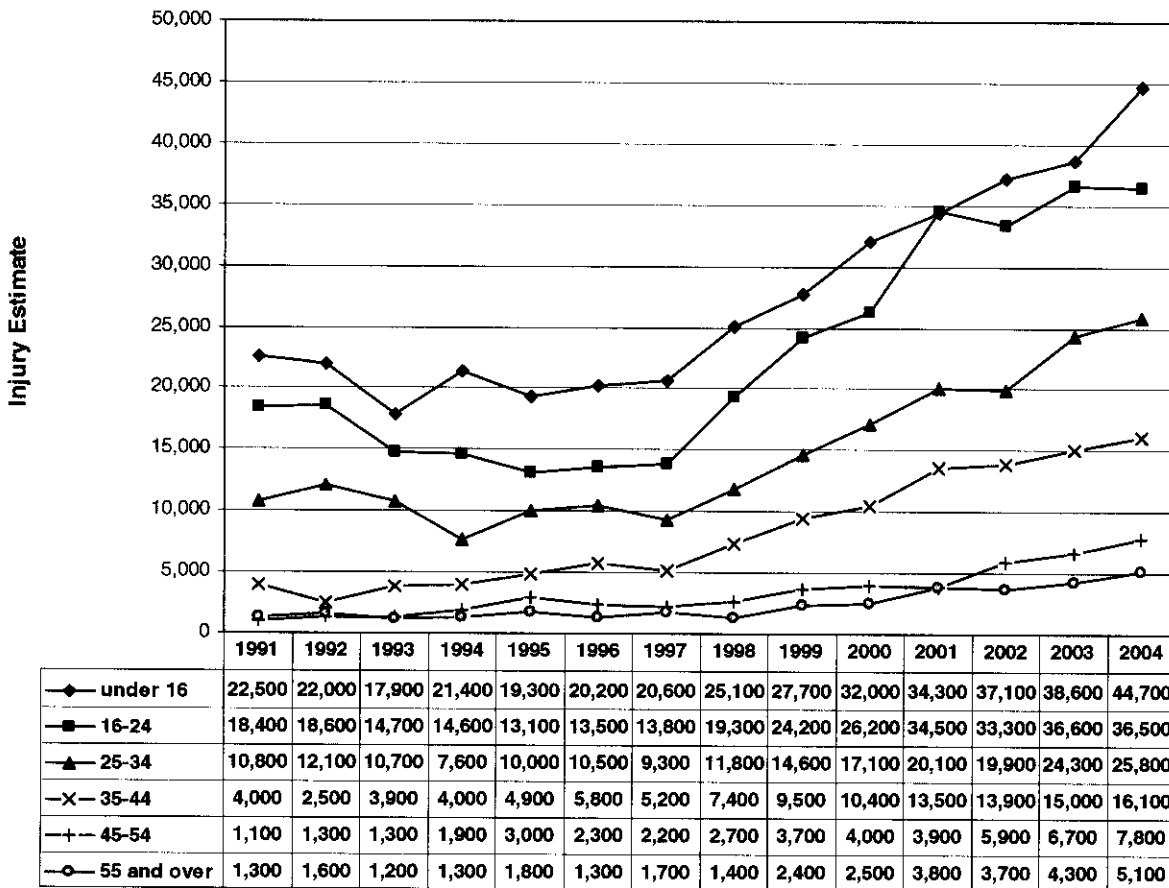Note: Coefficients of variation for injury estimates for all ages between 1997 and 2004 range from 9 percent to 11 percent. For ages under 16, the CVs of the injury estimates between 1997 and 2004 range from 9 percent to 13 percent. CVs for years prior to 1997 are not available. See Appendix B for an explanation of the use and calculation of CVs.

Figure 1 on the next page presents annual estimates by age group for ATV-related injuries treated in hospital emergency rooms since 1991.

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[8] Estimates have been adjusted according to the methodology in Appendix B.
[9] Adjusted estimates for children under 16 years old were not computed prior to 1985.

Figure 1
Annual ATV-Related Injury Estimates[10]
ATVs with 3, 4 or Unknown Number of Wheels
1991-2004

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
—♦— under 16	22,500	22,000	17,900	21,400	19,300	20,200	20,600	25,100	27,700	32,000	34,300	37,100	38,600	44,700
—■— 16-24	18,400	18,600	14,700	14,600	13,100	13,500	13,800	19,300	24,200	26,200	34,500	33,300	36,600	36,500
—▲— 25-34	10,800	12,100	10,700	7,600	10,000	10,500	9,300	11,800	14,600	17,100	20,100	19,900	24,300	25,800
—X— 35-44	4,000	2,500	3,900	4,000	4,900	5,800	5,200	7,400	9,500	10,400	13,500	13,900	15,000	16,100
—+— 45-54	1,100	1,300	1,300	1,900	3,000	2,300	2,200	2,700	3,700	4,000	3,900	5,900	6,700	7,800
—○— 55 and over	1,300	1,600	1,200	1,300	1,800	1,300	1,700	1,400	2,400	2,500	3,800	3,700	4,300	5,100

Source: National Electronic Injury Surveillance System, U.S. Consumer Product Safety Commission.
Columns may not add to annual totals due to rounding.

In 2004, the estimated number of injuries increased in every age group except the 16- to 24-year-old age group, though most of the increases were not statistically significant. The greatest percentage change in number of injuries occurred in the 55-and-over age group, which experienced a 19 percent increase. This increase was not statistically significant. The 45- to 54-year-old age group and the under-16 age group both experienced increases of about 16 percent. The increase in the 45- to 54-year-old age group was not statistically significant, but the increase in the under-16 age group was. The 35- to 44-year-old age group underwent a seven percent increase; the 25- to 34-year-old age group had a six percent increase; and the 16- to 24-year-old group decreased by less than one percent. None of these three changes was statistically significant.

Table 6 shows estimates of four-wheel ATV-related injuries and risk of injury for January 1, 1985 through December 31, 2004. Four-wheel injuries constituted 95 percent of the total estimate for ATVs with three, four or an unknown number of wheels in 2004. The injury estimate for 2004 represents an increase of 11 percent over the estimate for 2003 and is statistically significant (p = 0.0446). It also is a

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[10] Estimates have been adjusted according to the methodology in Appendix B.

statistically significant increase over the injury estimate for 1998 (p < 0.0001). There was a statistically significant upward trend in injuries (p = 0.0003) associated with four-wheel ATVs between 1998 and 2004.

In Table 6 risk is defined as the estimated number of injuries divided by the number of vehicles in use, multiplied by 10,000. Levenson's analysis of ATV injury risk estimates showed that there was no statistically significant trend, positive or negative, in injury risk from 2001 to 2004, the years for which the necessary data for testing is available (p = 0.4483) (Levenson, 2005b).

Table 6
Estimated Number of Injuries And Risk of Injury
Associated with Four-Wheel ATVs
January 1, 1985 – December 31, 2004

Year	Injury Estimate[11]	Estimated 4-Wheel ATVs in Use (millions)[12]	Risk Estimate per 10,000 4-Wheel ATVs
2004	129,500	6.9	187.9
2003	116,600	6.2	188.4
2002	104,800	5.5	190.0
2001	98,200	4.9	200.9
2000	82,300	4.2	197.2
1999	68,900	3.6	193.0
1998	57,100	3.1	184.7
1997	39,700	2.7	146.1
1996	40,700	2.4	168.1
1995	36,200	2.2	165.7
1994	33,300	2.0	165.4
1993	32,000	1.9	164.9
1992	33,000	1.9	175.1
1991	34,400	1.8	188.1
1990	30,800	1.8	175.1
1989	35,700	1.6	217.8
1988	39,400	1.4	276.1
1987	33,900	1.1	305.9
1986	23,400	0.7	319.2
1985	14,700	0.4	391.1

Source: U.S. Consumer Product Safety Commission, Directorate for Epidemiology, Division of Hazard Analysis; National Electronic Injury Surveillance System; and the Directorate for Economic Analysis.
Note: CVs for estimates in column 2 of this table for the years 1997 to 2004 range from 8.8 percent to 10.7 percent. CVs for estimates in column 3 for the years 2001 to 2004 range from 3.2 percent to 3.6 percent. CVs for estimates in column 4 for the years 2001 to 2004 range from 9.3 percent to 10.0 percent (Levenson, 2005b and 2005c). CVs for years prior to 2001 for columns 3 and 4 are not available.

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[11] Annual estimates have been adjusted according to the methodology in Appendix B.
[12] Rounded.

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Discussion

In analyzing deaths and injuries associated with ATVs, it is useful to consider three distinct periods, the boundaries of which are determined by changes in CPSC's data collection abilities. By considering these three periods separately, we can compare years within periods, thereby controlling for changes in data collection abilities or effects of external factors. While the boundaries of the periods considered here will be defined for convenience by factors involving the collection of death data, it is also useful to consider the injury estimates within the same periods and their relationship to the death estimates.

The first period, from 1982 to 1998, started when CPSC began calculating estimates of deaths associated with ATVs and ended at the transition from the use of ICD-9 for classification of deaths to ICD-10. This transition is discussed in the methodology section of this report (Appendix B). While not by design, this period contains the years in which the Consent Decrees were in effect. The second period, from 1999 to 2001, began with the transition to ICD-10. The second period ended at the last complete year of death data collection, which is currently 2001. The third period, from 2002 to 2004, spans the period of incomplete data collection for deaths to the present. The third period also begins with the year that the Consumer Federation of America petitioned CPSC to ban the sale of adult-sized ATVs for use by children under 16. One result of the petition has been an increase in media attention to deaths associated with ATVs, thus increasing CPSC's ability to gather death reports.

During the first period (1982 to 1998), reported deaths reached a high of 299 in 1986. Reported deaths that year were mostly deaths associated with three-wheel ATVs, which were still being manufactured and sold. The estimated number of injuries associated with ATVs (with three, four or an unknown number of wheels) rose above 100,000 for the first times in 1985 and 1986. The estimated number of deaths on four-wheel ATVs was relatively low in the earlier half of this period, probably because three-wheel ATVs were still heavily in use and four-wheelers were only beginning to gain in popularity.

CPSC's ability to gather reports of deaths during the first period was limited by certain ICD-9 reporting requirements (see Appendix B). Because of this, the estimated numbers of deaths in the first period were likely underestimates. However, general upward or downward directions may still be evident even with underestimates if the underestimation was fairly constant from year to year. It is likely that the estimated numbers of deaths in the first period were in fact underestimated by the same amount. Factors contributing to this are discussed below.

The ICD-9 reporting requirements made it difficult for CPSC to purchase death certificates from the states for deaths associated with ATVs occurring on public roads. If ATV fatalities were more likely to have occurred on a public road than in a private location in (for example) 1997 than in 1991, then the estimates for the two years would not have been equally underestimated. Likewise, if deaths of four-wheel ATV riders were more likely to occur on public roads than deaths of three-wheel ATV riders, then estimates for the two years would not have been equally underestimated. We have no reason to believe that either of these factors was present (nor any other factor influencing underestimation other than ICD-9).

Because data collection was substantially constant in methodology throughout the first period, relative comparisons among the annual estimated numbers of deaths within the first period can be made with caution. For instance, we note that it is likely that the number of deaths associated with three, four or an unknown number of wheels peaked around 1986 and experienced a low point around 1993 during

the first period. Similarly, a general increase may be noted in the estimated deaths associated with four-wheel ATVs from around 1993 to the end of the period (2001). Note that these generalizations do not require a discussion of the magnitude of the estimates.[13]

A similar pattern of peaks and valleys occurred with the estimated number of injuries associated with ATVs with three, four or an unknown number of wheels during the first period, suggesting that the pattern seen in the estimated number of deaths is not an artifact of the data.

The second period contains three years in which CPSC had unparalleled opportunities to collect comprehensive death data on ATVs. It also predated the 2002 petition from the Consumer Federation of America currently before the Commission. Consequently, the effect of increased media exposure of the ATV issue on data collection was not in play during the second period, as it is during the third period. Reported deaths increased by 27 percent during the second period. The estimated numbers of injuries associated with three, four or an unknown number of wheels during this period are part of a larger increasing trend from 1998 to 2004, but there are yearly significant increases within the second period as well.

The third period contains three years of incomplete death data collection. Because the number of reported deaths for these years will likely increase and the estimated numbers of deaths and the estimated risk of death will change in future reports, conclusions using these estimates from the third period should be made with caution. The injury estimates in the third period for both ATVs associated with three, four or an unknown number of wheels and for four-wheel ATVs alone – for which data collection is complete – are high. However, analysis has demonstrated that there is no statistically upward or downward trend in the risk of injury from 2001 to 2004 (the years for which the necessary data are available) (Levenson, 2005a).

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[13] The reader is cautioned against making similar generalizations regarding the estimated number of ATVs in use and the estimated risk of death, since these estimates may be subject to sources of error other than those mentioned here.

Appendix A

Table 7
Reported ATV-Related Deaths by Year and Age Group
ATVs with 3, 4 or Unknown Number of Wheels
January 1, 1982 to December 31, 2004

Year[14]	0-11 Years Old	0-11 Years Old Percent of Total	0-15 Years Old	0-15 Years Old Percent of Total
Total	**845**	**13%**	**2,019**	**31%**
2004	*49*	*10*	*130*	*28*
2003	*64*	*11*	*140*	*25*
2002	*44*	*8*	*133*	*25*
2001	57	11	130	26
2000	50	11	124	28
1999[15]	34	9	90	23
1998	30	12	82	33
1997	38	16	79	33
1996	40	16	87	35
1995	26	13	64	32
1994	20	10	54	27
1993	18	10	59	32
1992	32	14	71	32
1991	40	17	68	30
1990	27	12	81	35
1982-1989	276	18	627	40

Source: U.S. Consumer Product Safety Commission, Directorate for Epidemiology, Division of Hazard Analysis.
Italics denote the period for which reporting is incomplete.

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[14] Reporting is incomplete for 2002-2004. Reporting for 2000 and 2001 is substantially complete, but future reports for these years may result in slight differences in Table 7 in future reports. Percentages for years for which reporting is incomplete should be interpreted with caution because the rate at which deaths are reported may not be consistent across all age groups.

[15] Beginning in 1999, deaths were coded under the Tenth Revision of the International Classification of Diseases (ICD-10). See Appendix B for a discussion of the effect of this change.

Appendix B

Methodology

Deaths

CPSC staff estimates the number of deaths associated with ATVs by use of a capture-recapture approach. This approach involves examining the numbers of reports of fatalities gathered by two different methods. The first method is the collection of death certificates purchased from the states, where the death was deemed ATV-related by the medical examiner. These incidents are entered into CPSC's death certificate database (DTHS). The second method is the collection of various types of reports of fatal ATV-related incidents by any other means available to the agency: news clips, reports from the Medical Examiners' and Coroners' Alert Project (MECAP), reports from consumers via phone or Internet, hospital reports from the National Electronic Injury Surveillance System (NEISS), as well as other types of reports.

Table 1 presents counts of deaths reported to CPSC that have not been reported in previous years. Additional reports that are duplicates of ones counted in previous versions of this annual report may have been received (e.g., CPSC may have received a news clip about a death that originally was reported via a MECAP report in a prior year). Counts of these duplicate reports are not included in Table 1.

The calculation of the capture-recapture estimate entails examining the number of incidents included in DTHS or from non-DTHS sources as well as the number included on both lists of incidents. The estimate is given by

$$estimate = \frac{(M+1)(N+1)}{n+1} - 1 \qquad\qquad Formula\ 1$$

where

M is the number of incidents captured by purchase of death certificates from the states,

N is the number of incidents collected by other means, and

n is the number of incidents captured by both death certificate purchase and by at least one other source.

Estimates of fatalities occurring after January 1, 1999 that were associated with ATVs with three, four or an unknown number of wheels were calculated using formula 1.

In 1999, CPSC began collecting death certificates of all fatalities involving an ATV, as coded under the Tenth Revision of the International Classification of Diseases (ICD-10). ICD-10 marks the first revision for which all ATV-related fatalities are grouped under a single code, thus facilitating more complete collection of these incidents by CPSC than was accomplished prior to 1999.

Prior to 1999, CPSC received death certificates only of fatalities occurring in places other than public roads and of fatalities occurring in public road locations that were erroneously reported as non-public-road locations. Because of this, the procedure for estimating ATV-related deaths had two parts. Because death certificates generally were not collected for public road fatalities, the count for these fatalities was the number of reports received, mostly in the Injury or Potential Injury Incident file (IPII). For incidents occurring in other places, the capture-recapture approach was applied. The two parts (incidents occurring on public roads and incidents occurring in other places) were then combined for the annual estimate of deaths, as in the following formula:

$$estimate = \frac{(M_{NP}+1)(N_{NP}+1)}{n_{NP}+1} - 1 + C_P \qquad\qquad Formula\ 2$$

where

M_{NP} is the number of reports of non-public-road fatalities captured by purchase of death certificates from the states,

N_{NP} is the number of reports of non-public-road fatalities collected by other means,

n_{NP} is the number of reports of non-public-road fatalities captured by both death certificate purchase and by at least one other source,

and

C_P is the count of reports of ATV-related fatalities occurring on public roads from any source.

We believe estimates for years prior to 1999 to be under-estimates because those estimates used only the available count of public road fatalities, and did not account for missing reports. Since CPSC now receives death certificates for ATV incidents occurring anywhere, the capture-recapture approach has been utilized for the entire estimate of ATV-related deaths from 1999 forward. The resulting estimates of deaths after January 1, 1999 represent a better approximation of the number of deaths associated with ATVs.

A number of incidents reported to CPSC involve ATVs for which the number of wheels is unknown. Because some of these actually involve four-wheel ATVs, the unknowns are apportioned in the calculation of the estimated number of deaths associated with four-wheelers. This estimate was calculated by first dividing the reported number of deaths for four-wheel ATVs by the combined reported number of deaths for three- and four-wheel ATVs, then multiplying this quotient by the estimated number of deaths for all ATVs (three, four or unknown number of wheels). Thus, the estimate of deaths associated with four-wheel ATVs is given by

$$Estimate_{4W} = \frac{rep_{4W}}{rep_{3W+4W}} Est_{3W+4W+UW} \qquad\qquad Formula\ 3$$

where

$Estimate_{4W}$ is the estimated number of fatalities associated with four-wheel ATVs,

rep_{4W} is the reported number of fatalities associated with four-wheel ATVs,

rep_{3w+4w} is the reported number of fatalities associated with three- and four-wheel ATVs, and

$Est_{3w+4w+uw}$ is the estimated number of fatalities associated with ATVs with three, four or an unknown number of wheels.

Risk of death associated with four-wheel ATVs was calculated by dividing the annual estimate by the number of ATVs in use in a given year. Annual ATV population estimates are based on ATV sales and operability rates based on exposure studies conducted by industry.[16] Annual population estimates for 1994 and prior years were computed from a survival model derived from 1994 data. Annual population estimates for years 2001 and after were computed from a survival model derived from 2001 data. Population estimates for the intervening years come from a model that provides a smooth transition between the 1994 and the 2001 models. The estimated number of four-wheel ATVs in use in Tables 4 and 5 are rounded figures. Risk estimates calculated using these rounded figures may not match those in the tables because of this.

Because reliable operability rate data are not available for three-wheel ATVs, the risk of death is given in this report only for four-wheel ATVs.

Fatal incidents considered in-scope in this report include any unintentional incident involving an ATV, whether or not the ATV was in operation at the time of the incident. Because of the difficulties inherent in distinguishing between occupational and non-occupational use, occupational fatalities are included when reported to CPSC. For instance, a fatality that occurs when a victim is riding alongside a fence on a ranch for the purpose of checking it and then overturns his ATV while deviating from his usual work routine to take a "joy ride" up a nearby hill may be difficult to classify. In addition, ATVs are primarily recreational products, and the relative proportion of occupational fatalities in this report is small.

Injuries

All injury estimates in this report were derived from data collected through CPSC's National Electronic Injury Surveillance System, a probability sample of U.S. hospitals with 24-hour emergency rooms and more than six beds (Schroeder and Ault, 2001a and 2001b). Estimates have been adjusted due to revisions in the NEISS Coding Manual in 1985, as well as to account for NEISS sampling frame updates (Marker, et al, 1988; Marker and Lo, 1996). Estimates for 1982 through 1985 were adjusted based on a review of NEISS comments to exclude dune buggies and identify ATVs classified as mini or trail bikes.

Injury estimates for 1985, 1989, 1997 and 2001 are based on injury surveys using NEISS cases. Injury estimates for other years have been adjusted by factors to account for out-of-scope (non-ATV) cases based on injury studies in those years (Levenson, 2003c; Rodgers and Zamula, 1986; Rodgers, 1990; U.S. CPSC, 1998). An in-scope case was defined to be any non-occupational, unintentional case involving an ATV, whether or not the victim was operating the ATV at the time of the incident.

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[16] See Levenson, M., 2001 ATV Operability Rate Analysis, memorandum. May 6, 2003. U.S. Consumer Product Safety Commission. Also see Levenson, M. *All-Terrain Vehicle 2001 Injury and Exposure Studies*. U.S. Consumer Product Safety Commission. January 2003.

(NEISS does not collect occupational injuries.) The adjustment factors were 0.93 for 1986 through 1988, 0.95 for 1990 through 1996, 0.903 for 1998 through 2000 (amended from 0.935) and 0.922 for 2002 and after.

A coefficient of variation (or CV) is an expression of the variability of an estimate relative to the estimate itself. In this report CVs for injury estimates are given as percents. The adjustment factors discussed above are also estimated and have associated variability. This variability (along with the variability of the injury estimates) affects significance tests and tests for trends. These concepts are more fully discussed in Levenson 2003c and Levenson 2005c.

NEISS includes incidents associated with ATVs for which the number of wheels is unknown. Because of this, the unknowns are apportioned in the calculation of the estimated injuries associated with four-wheelers. The four-wheel calculation was accomplished by the following formula:

$$Total\ Estimate_{4W} = \frac{Estimate_{4W}}{Estimate_{3W+4W}}\left(Estimate_{3W+4W+UW}\right) \qquad Formula\ 4$$

where

$Total\ Estimate_{4W}$ is the total estimated injuries associated with four-wheel ATVs with unknowns apportioned,

$Estimate_{4W}$ is the estimated injuries associated with four-wheel ATVs not including unknowns,

$Estimate_{3W+4W}$ is the combined estimated injuries associated with three- and four-wheel ATVs (not including unknowns),

$Estimate_{3W+4W+UW}$ is the combined estimated injuries associated with ATVs with three, four or an unknown number of wheels.

Risk of injury in this report is defined as the estimated number of injuries divided by the number of vehicles in use, multiplied by 10,000. Annual ATV population estimates were the same as those used in the calculation of risk of death and are discussed elsewhere in this appendix.

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