

D18(YELL)

October 15, 2009

Dear Interested Party:

We received your letter commenting on winter use in Yellowstone National Park. We wish to take this opportunity to provide you with the most up-to-date information about monitoring and science related to winter use in the park.

For the past five winters, a managed winter use program has been in place in Yellowstone. Visitors on snowmobiles must use Best Available Technology (BAT) machines. Visitors must also be accompanied by a commercial guide; in other words, visitors cannot snowmobile in Yellowstone without a guide. A daily limit on snowmobile and snowcoach numbers has been in place, and speed limits are reduced in the busy travel corridors. Some older snowcoaches have also been retrofitted and made cleaner and quieter. The park is closed to oversnow motorized travel at night. Oversnow vehicles have never been allowed to travel off roads in the park. Both commercially guided snowmobiles and snowcoaches are used to provide access to the many features of the park in winter. These two types of oversnow vehicles are used as forms of transportation, not recreational activities unto themselves. Recent winter conditions are dramatically different and significantly improved over the conditions that existed in the 1990s.

### **Recent Use**

The number of commercially guided snowmobile groups has been similar in number to commercially guided snowcoaches over the past few winters. The number of people per snowmobile group has been slightly higher than people per snowcoach.

- 2008-2009: Commercially guided snowmobile use averaged 205 snowmobiles per day with a peak day of 426 snowmobiles. There was an average of 31 groups per day, 6.6 snowmobiles per group, and 8.9 people per group. Snowcoaches averaged 29 per day with a peak day of 54 coaches. Each coach carried an average of 8.5 people.
- 2007-2008: Commercially guided snowmobile use averaged 294 snowmobiles per day with a peak day of 557 snowmobiles. There was an average of 36 groups per day, 6.9 snowmobiles per group, and 9.3 people per group. Snowcoaches averaged 35 per day, with a peak day of 60 coaches, and 8.8 people per coach.
- 2006-2007: Commercially guided snowmobile use averaged 299 snowmobiles per day with a peak day of 542 snowmobiles. There was an average of 42 groups per day, 6.9 snowmobiles per group, and 9.1 people per group. Snowcoaches averaged 34 per day with a peak of 58, and 8.7 people per coach.

## **Monitoring**

A fundamental purpose of the National Park Service (NPS) is to ensure that park resources are protected. An extensive resource monitoring program has been in place, and the monitoring results reported in the following studies include the wide range of use levels that has been experienced in the last five winters (including 32 days with snowmobile numbers greater than 400 per day and 28 days with snowcoach numbers greater than 50 per day).

### ***Air Quality***

Air quality is very good to excellent in the winter. Best Available Technology snowmobiles, limits on numbers of oversnow vehicles, and commercial guiding have all contributed to the improvements in air quality. The BAT technology snowmobiles are currently all four-stroke machines that produce far less pollution than traditional two-stroke snowmobiles. Yellowstone intends to implement a BAT requirement for snowcoaches in the future that would continue to improve air quality.

The current state of vehicle emissions is found in an August 2009, peer reviewed paper, “Portable Emission Measurements of Yellowstone Park Snowcoaches and Snowmobiles” by Gary A. Bishop, Ryan Stadtmuller, Donald H. Stedman, and John D. Ray, *Journal of the Air and Waste Management Association*, 59:936–942. The authors found:

“...the two primary winter vehicles in Yellowstone National Park are now very similar in their per passenger emissions,” (page 936).

“Despite the use of a standardized route and passenger loading, road and snow conditions can contribute to large increases in CO and HC emissions when comparing similarly equipped snowcoaches. Only the Bombardiers’ that have been upgraded with a modern fuel-injected engine have proven to have the power-to-weight ratio needed to avoid extensive power enrichment excursions during poor road conditions. This means that even an upgraded snowcoach fleet operating in Yellowstone National Park will have days for which emission levels might exceed desired limits,” (page 941).

“The complex issue of how winter visitors should travel in the park during their visits cannot be answered by simply comparing vehicle emission levels. However, snowmobile emission levels were one of the issues publicly highlighted when the first lawsuits were filed against the NPS seeking to change the winter access rules. This and previous works have sought to provide a more complete picture of vehicle emissions and activity data that were not previously available to the NPS. The good news is that technological improvements in both snowmobiles and snowcoaches have contributed to lower the emissions from both types of vehicles to the point that per-passenger emissions are now similar,” (page 942).

Carbon monoxide concentrations did increase from the winter of 2006-2007 to the winter of 2007-2008 when measured at the West Entrance Station. According to the report, "Winter Air Quality in Yellowstone National Park, 2007-2008" by John D. Ray, Ph.D., National Park Service, "The maximum 1-hour and 8-hour CO [concentrations] have approximately doubled from the winter of 2006-2007 to the winter of 2007-2008 at the West Entrance," (page 6). Dr. Ray also notes, "Official counts...of West Entrance snowmobiles were down slightly for the winter of 2007-2008, however the number of snowcoaches continued to increase," (page 9). West Entrance snowmobile numbers went from 14,682 to 14,135 while snowcoach numbers increased from 1,453 to 1,582 in 2006-2007 as compared to 2007-2008 (page 10).

Inversions, which trap pollutants near the ground, especially on cold, calm mornings, are an important factor in winter air pollution levels. According to the above report, "There were several important weather factors associated with eight hourly CO concentrations that were greater than 2 ppm. [in the winter of 2007-2008] The factors were: calm winds below 0.2 m/s, cold temperatures less than -25 deg C, and winds from the East," (page 10).

The "carbon footprint" is another way of comparing modes of transportation. Snowcoaches use more fuel on a per rider basis than do snowmobiles. Snowcoaches average 3.43 miles per gallon, while BAT snowmobiles average 25.1 miles per gallon. On a per rider basis, using a standardized route and recent occupancy figures, each snowmobile visitor taking a 70 mile tour of Yellowstone would consume 2.29 gallons of fuel. Each snowcoach visitor would consume 2.55 gallons of fuel for the same tour. As indicated in the air emissions report above (Bishop, et al.), rough roads and soft snow conditions mean that even a future, upgraded, all BAT snowcoach fleet would have days in which emission levels might exceed desired limits.

### ***Health and Safety***

Personal exposure of employees to air pollutants has been greatly reduced as compared to the 1990s. Some recent monitoring indicated small exceedances of standards for benzene and formaldehyde. However, the report for this last winter's monitoring, "Personal Exposure Monitoring of Entrance Station Employees at West Yellowstone Entrance – President's Weekend 2009" by Tim Radtke, Industrial Hygienist, Office of Occupational Health and Safety, Department of the Interior, showed no exceedances of Occupational Health and Safety Administration (OSHA), National Institute for Occupational Safety and Health (NIOSH), or American Conference of Governmental Industrial Hygienist (ACGIH) limits. Also, last winter's monitoring, for the first time, separated snowmobiles and snowcoaches and monitored employee exposure to pollutants from each. The report found similar air emission results from snowmobiles and snowcoaches. A table attached to this email summarizes the results of the sampling comparing the two vehicle types.

### ***Wildlife***

Winter use will have some effects on wildlife, just like every other form of visitor access to the park. Extensive studies of the behavioral responses of five species (bison, elk, bald

eagle, trumpeter swans and coyotes) to over snow traffic showed that these animals rarely showed high-intensity responses (movement, defense postures, or flight) to approaching vehicles. For individual animals, 8 to 10 percent of elk and bison show a movement response to snowmobiles and snowcoaches. Approximately 90 percent of elk or bison either show no apparent response or a "look and resume" response. This level of reaction was consistent for a wide range of daily average oversnow vehicle use (ranging from 156 to 593 vehicles per day).

Thirty-five years of census data do not reveal any relationship between changing winter use patterns and elk or bison population dynamics. No wildlife populations are currently declining due to winter use (swan populations are declining, but this decline is being experienced regionally and due to factors unrelated to winter use in the park or region). Use will be well below levels previously studied by NPS wildlife biologists and well within the limits recommended by those studies. There is no reason to suspect that recent winter use levels pose a risk of unacceptable impacts or impairment to any wildlife population. All visitors utilizing motorized oversnow vehicles travel with commercial guides, learning about and enjoying the abundant wildlife sightings.

One issue that has been raised is that oversnow vehicle numbers will exceed those recommended by wildlife biologists. This statement is not supported by the peer reviewed scientific journal article, "Behavioral Responses of Bison and Elk in Yellowstone to Snowmobiles and Snow Coaches" by John J. Borkowski, P.J. White, Robert A. Garrott, Troy Davis, Amanda R. Hardy, and Daniel J. Reinhart. *Ecological Applications* 16(5) 2006, (pages 1,911-1,925). In the article, the authors make it clear that the monitoring period they are referring to is from 1999 through 2004. Average daily oversnow vehicle use extended up to 593 per day during the 2002 winter. Maximum daily numbers extended up to 1,168 oversnow vehicles during the study. Cumulative oversnow vehicle entries for the winter season for the West Entrance alone extended up to 46,885 for the winter season (data are found on page 1,915 of the paper). At the conclusion (page 1,924), the authors state:

"This study documented that winter visitors traveling on OSVs were essentially confined to the groomed roads, typically behaved appropriately when viewing wildlife, and rarely approached wildlife except when animals were on or immediately adjacent to the road. These attributes have allowed elk and bison in Yellowstone to habituate somewhat to OSV recreation, commonly demonstrating no observable response, and rarely displaying "fight or flight" responses when animals were off road. Further, available data provide no evidence that levels and patterns of OSV traffic during the past 35 years adversely affected the population dynamics or demography of elk and bison. Thus, we suggest regulations restricting the levels and travel routes of OSVs during our study were effective at reducing disturbances to bison and elk below a level that would cause measurable fitness effects. We acknowledge the potential for fitness effects to develop if OSVs or other stressors become more severe or prolonged. Thus, we recommend park managers consider maintaining OSV traffic levels at or below those observed during our study [up to an average of 593]. Regardless, numerous

studies have shown that scientific findings rarely persuade people to alter their values or beliefs (e.g., Meadow et al. 2005). Thus, we suspect that varying interpretations of the behavioral and physiological response data will continue to exist because of the diverse values and beliefs of the many constituencies of Yellowstone National Park.”

Based on wildlife monitoring, the odds of eliciting a movement response were higher for snowcoaches than snowmobiles. In the paper, “Behavioral Responses of Wildlife to Snowmobiles and Coaches in Yellowstone” by P.J. White, Troy Davis, John J. Borkowski, Robert A. Garrott, Daniel P. Reinhart, and D. Craig McClure (2006), the authors found, “The odds of observing a movement response were 1.1 times greater for each additional snowmobile, 1.5 times greater for each additional coach...” (page 12).

### *Soundscapes*

Soundscapes are good to very good in the park. Some winters have seen the percent of time oversnow vehicles are heard exceed NPS goals. As described below, snowcoaches are contributing almost equally as snowmobiles to these concerns. In addition, some oversnow vehicles remain too loud, but they are overwhelmingly snowcoaches. As with air emissions, these results illustrate why the NPS is proposing snowcoaches also meet a BAT requirement for sound.

Snowcoaches contribute almost the same as snowmobiles to the percent of time oversnow vehicles are heard. In the draft report, “Natural Soundscape Monitoring in Yellowstone National Park, December 2008 –March 2009,” by Shan Burson, Yellowstone National Park, five winters of monitoring, comprising 189 hours of observational studies, are presented in Appendix E. During those winters, 830 commercially guided snowmobile groups (totaling 5,699 individual snowmobiles) were heard for approximately 32 hours, while 745 commercial guided snowcoaches were heard for approximately 26 hours. That is, on average, each commercial snowmobile group was heard for 2 minutes and 20 seconds, while each commercial snowcoach was heard for 2 minutes and 5 seconds. Thus, commercially guided snowmobile groups and commercially guided snowcoaches, which have been similar in numbers the past few winters, contribute similarly to the amount of time oversnow vehicles are heard. According to the above report, commercial guiding helps reduce sound levels by keeping vehicles grouped together and by reducing idling.

Best Available Technology snowmobiles sound similar to snowcoaches (and automobiles in the summer). They all use four-stroke engines which have similar frequencies or tonal qualities.

Concerns remain with some vehicles being too loud; however, 94 percent of the loud vehicles are snowcoaches (see page 40 of the above referenced report). In a winter 2009 study of snowcoach sound, both unmodified, older Bombardier snowcoaches as well as a number of modern coaches exceeded the desirable sound limits for oversnow vehicles. The draft report, “Exterior Sound Level Measurements of Snowcoaches at Yellowstone

National Park,” by the John A. Volpe, National Transportation Systems Center of the U.S. Department of Transportation (August 2009), documents that a number of modern coaches with modern emission control systems are too loud (pages 14 and 37 of the report). As noted above, Yellowstone intends to implement BAT requirements for snowcoaches in the future to address this concern. The NPS intends to require coaches meet a BAT requirement similar to snowmobiles in the future. Best Available Technology snowmobiles are noticeably quieter than non-BAT snowmobiles (by five decibels, which is an audible reduction in noise). In the future, all snowcoaches would be required to meet a similar standard.

### ***Other Issues***

Another area of concern with increasing snowcoach use has been damage to snow roads. In the 1990s, snowcoaches averaged about 15 vehicles per day. In 2007-2008, coaches peaked at 60 per day. With this growth in numbers, and the increase in larger, heavier coaches, park staff observed rutted, torn-up snow roads from snowcoach use.

In an earlier report, “Snowmobile Trail Bump Formation: Analysis, Prediction, and Modeling” by Russ Alger, Scott Gruenberg, and Geoff Gwaltney, Michigan Technological University (2002), snowcoach effects on snow road surfaces were examined separate from snowmobile use in a limited study. The authors found,

“Snow coaches degrade the snow road surface in a manner that is not similar to snowmobiles. It appears that there is little generation of short, choppy bumps caused by snow coaches, although this conclusion is not drawn from long periods of traffic in as large numbers as snowmobiles. Only a limited number of passes were made over the controlled section test and these bumps were not seen. The snow coaches do tend to rut the surface parallel to the line of travel and also loosen up the surface considerably. It is uncertain whether or not this would cause problems to extended heavy use by coaches,” (page 37).

These concerns are why the NPS has imposed size and weight limits on snowcoaches and continues to be concerned about these effects as coach numbers have increased.

### ***Visitor Experience***

A key part of the NPS mission is visitor use and enjoyment. In the winter, visitor satisfaction studies show that visitors are enjoying the park, and they accept the management that is in place. The report, “Winter Experiences of Old Faithful Visitors in Yellowstone National Park” by Wayne Freimund, Mike Patterson, Keith Bosak, and Shelly Walker Saxen, University of Montana, discusses a winter 2008 study of visitor perception of soundscapes and wildlife. Fifty-seven percent of visitors surveyed toured the park in a snowcoach, 41 percent snowmobiled, 26 percent cross-country skied, and 25 percent snowshoed. Sixty-three percent of respondents spent more than one day in the park. The survey occurred in the Old Faithful area, and respondents had accessed the area via either snowcoach or snowmobile.

Soundscapes Survey Summary (page 62 of the report):

“The survey results suggest that winter visitors to Old Faithful agree that Yellowstone is a place for natural quiet, to hear natural sounds and a quiet place. There is less agreement that Yellowstone is a place free of motorized noise. The opportunity to experience natural sounds is perceived to be important to both the value of Yellowstone and the visitors’ experience. While there are some variations in the importance of sound when activity type is considered, those differences are largely within how much positive support there is for Yellowstone as a place for natural quiet and to hear natural sounds. Visitors who participated in snowmobiling or snow coach touring were somewhat less likely to agree that the Yellowstone is a ‘place free of motorized noise.’

“Eighty-one percent of the respondents indicated that the natural sounds had a positive effect on their experience. Satisfaction with the natural sounds within their trip remained high and seventy-one percent of the visitors suggested they experienced the level of natural sound they desired for half or more of the time they desired it. Eighty-seven percent of the respondents were ‘very satisfied’ with their overall experience and the remaining thirteen percent were ‘satisfied.’

“Respondents were asked about their support for a variety of management actions ‘to protect opportunities to experience natural sounds.’ Requiring best available technology, continuing to require guides, limiting the total number of snow machines in the park per day and limiting group sizes to 11 per guide were strongly supported by a minimum of sixty-eight percent of the respondents. Closing the roads to all over snow vehicles or to snowmobiles only was opposed or strongly opposed by a majority of the respondents. Plowing the roads for automobile access was strongly opposed by seventy-one percent of the respondents and opposed by another nine percent.”

Wildlife Survey Summary (page 100 of the report):

“The wildlife survey results suggest that the opportunity to view bison remains an important part of the winter experience for visitors to Yellowstone National Park (71% of visitors described it as very to extremely important). And visitors overwhelmingly (87%) find this aspect of their Yellowstone winter experience very satisfying.”

Past winter surveys have also helped us understand that visitors cannot be classified by their mode of transportation. In the paper, “Winter Visitation to Yellowstone National Park: A Review of Six Years of Research” by Wayne A. Freimund and William T. Borrie of the University of Montana (2001), the authors found,

“Two of the earlier visitor studies demonstrated ...that grouping visitors according to activity (snowmobile versus snowcoach) is limited. Activity groups were not found to be useful for predicting either visitor behavior or visitor

attitudes. Visitors within the activity sought a variety of experiences. Indeed, the different activity groups had more in common than opposition relative to acceptance of management actions,” (page 41).

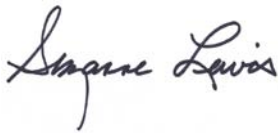
In an earlier section of the report, the authors describe motivation clusters or groups as a more accurate way of describing visitors, which transcend modes of transportation (pages 12 – 15).

## **Summary**

The recent science on winter use indicates park resources are in very good condition. For each topic monitored, we now understand that both snowmobiles and snowcoaches are contributing similarly to the measured impacts of winter use. The perception that snowmobiles are contributing to the vast majority of observed effects, and that those effects would greatly diminish with snowcoaches only, is not supported by the research. When managed, as they have been for the past five winters, both modes of transportation provide opportunities for visitors to enjoy the park. Each can offer different experiences for visitors, just as cross-country skiing, snowshoeing, and walking offer different opportunities for visitors to enjoy the park in the winter.

We hope this information will help you better understand the current status of winter use monitoring, studies, and science in Yellowstone National Park.

Sincerely,

A handwritten signature in cursive script that reads "Suzanne Lewis".

Suzanne Lewis  
Superintendent

Attachment

**Time-weighted Average for time sampled (calculated 8-hr TWA) Volatile Organic Compounds and Aldehyde Sample Results in Parts Per Million**

(from report "Personal Exposure Monitoring of Entrance Station Employees at West Yellowstone Entrance – President's Weekend 2009" by Tim Radtke, Industrial Hygienist, Office of Occupational Health and Safety, Department of the Interior)

Sample	Number of Vehicles	Date (sample duration in minutes)	Acetone	Benzene	Ethyl Alcohol	Decamethyl Cyclo Pentasiloxane	Naptha	Petroleum Distillates	Toluene	Xylene	Carbon Monoxide	Peak CO	Formaldehyde	Acetaldehyde	Acrolein
CG-2 Personal Sample Inside Kiosk B (snow coaches only)	19	2/15 (105)	<0.032	<0.052	<0.16	0.032(0.007)	<0.017	0.069 (0.015)	<0.021	<0.018	6 (1.3)	126	0.0073 (0.002)	<0.0058	<0.0012
DD-2 Personal Sample Inside Kiosk A (snow mobiles only)	221	2/15 (109)	<0.031	<0.051	<0.16	0.19(0.043)	<0.017	0.081 (0.018)	<0.021	<0.018	10 (2.3)	91	0.011 (0.002)	<0.0059	<0.0012
OSHA Permissible Exposure Limit 8-hr (PEL)			1000	1.0	1000	n/a	100	300	200	100	50		0.75 / 2.0*	200	0.1
American Conference of Governmental Industrial Hygienist Threshold Limit Value (TLV)			500	0.5	1000	n/a	n/a	n/a	50	100	25		0.3**	25**	0.1**
NIOSH Recommended Exposure Limit (REL)													0.016 / 0.1*	0.1 / 0.3*	0.016 / 0.1*

\*Short Term Exposure Limit \*\* Ceiling Limits