

Research Studies Related to Snowmobiling Impacts

PERSONAL EXPOSURE

The 'personal exposure' of snowmobilers and employees to 'toxic fumes' caused by snowmobile exhausts is sometimes raised by snowmobiling opponents in public lands planning processes. Like most other recent snowmobile-related issues, this topic has been fully addressed during the lengthy Yellowstone National Park Winter Use planning efforts. The most recent reports are summarized below.

1. **Personal Exposure Monitoring of Entrance Station Employees at West Yellowstone Entrance – President's Weekend 2009.** Memo from Industrial Hygienist, Office of Occupational Health and Safety, Department of the Interior (2009) http://www.nps.gov/yell/parkmgmt/upload/draft_pemr_2009.pdf

Summary: Personal monitoring of employees was conducted at West Yellowstone entrance to evaluate exposure to components of engine exhaust using standard industrial hygiene techniques. These contaminants included carbon monoxide, aldehydes such as formaldehyde, acetaldehyde and acrolein, and common hydrocarbons. Noise monitoring was also performed. **All results were below OSHA, ACGIH, and NIOSH occupational exposure limits.** The new ventilation system in the entrance station booths was not operating during the survey. It is recommended that this system be utilized during the high traffic volume periods to maintain positive pressure in the booths to further limit exposures.

Results: **Personal exposures to the organic solvent contaminants were well below the OSHA permissible exposure limits and the ACGIH threshold limit values. Most were below the detectable limits.** The types of chemicals detected were slightly different than last year's samples which may be the result of slightly different fuel mixtures. For example ethyl and isopropyl alcohols were not detected on the 2009 samples. Petroleum distillates were detected in slightly higher concentrations than last year's results but several orders of magnitude below a level of concern.

Carbon monoxide concentrations were slightly higher this year with an average 8-hr exposure of 1.3 ppm compared to last year's average of 0.4 ppm for entrance station employees (the 8-hr TWA corrects for differences in sampling time and represents their full shift exposure). This difference may be due to the absence of ventilation in the booths. Although these concentrations are relatively low, utilizing the positive pressure ventilation system in the booths would likely lower the carbon monoxide exposures further.

The aldehyde samples were well below the OSHA, ACGIH, and NIOSH exposure limits. The detection limit for the SEP-PAK cassette sampler using the 500 cc/min flow rate was generally an order of magnitude lower than the XAD tube sampling in 2008. Acrolein was not measured above the limit of detection in any of the samples and acetaldehyde was present in just one of the samples.

The peak noise exposure was 91 A-weighted decibels (dBA) and the time weighted average exposures were 69.1 dBA and 67.3 dBA. These are well below the OSHA action level and are consistent with last years noise exposures. Inclusion in a hearing conservation program is not warranted for this level of exposure.

2. **Yellowstone Winter Use Personal Exposure Monitoring.** Spear, T.M., Hart, J., & Stephenson, D.J. (2006) Rocky Mountains Cooperative Ecosystem Studies Unit; Montana Tech of the University of Montana and Boise State University. http://www.nps.gov/yell/parkmgmt/upload/personal_exposure.pdf

Executive Summary: In January 2006, the National Park Service contracted with Montana Tech of The University of Montana and Boise State University to evaluate employee exposure to air contaminants and noise associated with snowmobile operations in Yellowstone National Park. The exposure evaluations were performed

at the Park's West Entrance during the 2006 President's Day three-day weekend (February 18, 19, and 20). Further noise evaluations were also performed in Mammoth on February 27, 2006.

The employee exposure evaluations were performed during anticipated peak levels of snowmobile use in an attempt to obtain worst-case measurements during winter use work activities. Personal and area air sampling and noise monitoring were performed on Yellowstone National Park's West Entrance personnel and a park ranger. Personal and area air samples were collected for the following contaminants:

- Aldehyde screen
- BETX (benzene, ethyl benzene, toluene, and xylenes)
- Total hydrocarbons
- Volatile organic compounds (VOCs)
- Carbon Monoxide
- Respirable particulate matter (2.5 um, 4.0 um, and 10 um)
- Noise

With the exception of VOCs, the results of the current study were compared to established occupational exposure limits. These limits include permissible exposure limits (PELs) established by the Occupational Safety and Health Administration (OSHA), threshold limit values (TLVs) established by the American Conference of Governmental Industrial Hygienists (ACGIH), and recommended exposure limits (RELs) established by the National Institute of Occupational Health (NIOSH). VOC results were compared to Minimal Risk Levels (MRL) established by the Agency for Toxic Substance and Disease Registry (ATSDR). All employee exposures to the above air contaminants and noise were well below established occupational limits and MRLs except two short term benzene samples. The benzene samples were above the intermediate-duration inhalation exposure of 0.006 ppm, but below the acute-duration inhalation exposure of 0.009 ppm. The intermediate- duration is used for exposures from 14-364 days per year and the acute- duration is for exposure of less than 14 days per year. The results from the current study were also compared with the 2005 study to evaluate trends in Park Service personnel exposure to winter use vehicle emissions. Comparison of the 2005 study results with previous studies showed a general decrease in exposure to aldehydes, BETX, VOCs, and respirable particulate matter.

3. Yellowstone Winter Use Personal Exposure Monitoring. Spear, T.M., Hart, J., & Stephenson, D.J. (2005) Rocky Mountains Cooperative Ecosystem Studies Unit; Montana Tech of the University of Montana and Boise State University. <http://www.nps.gov/yell/parkmgmt/upload/personalexposure05.pdf>

Executive Summary: In January 2005, the National Park Service contracted with Montana Tech of The University of Montana and Boise State University to evaluate employee exposure to air contaminants and noise associated with snowmobile operations in Yellowstone National Park. The exposure evaluations were performed at the Park's West Entrance and Madison Warming Hut during the 2005 Martin Luther King three-day weekend (January 15th, 16th, and 17th) and the 2005 President's Day three-day weekend (February 19th, 20th, and 21st). Employee exposure evaluations were also performed at the Mammoth Hot Springs Maintenance shop on February 7, 2005.

The employee exposure evaluations were performed during anticipated peak levels of snowmobile use in an attempt to obtain worst-case measurements during winter use work activities. Due to the absence of inversions noted during the monitoring dates of the current study, worst-case data were not collected. Personal and area air sampling and noise monitoring were performed on Yellowstone National Park's West Entrance personnel, warming hut personnel, snowmobile mechanics, and park rangers. Personal and area air samples were collected for the following contaminants:

- Aldehyde screen
- BETX (benzene, ethyl benzene, toluene, and xylenes)
- Total hydrocarbons
- Volatile organic compounds (VOCs)
- Elemental and organic carbon
- Oxides of Nitrogen

- Carbon Monoxide
- Respirable particulate matter (2.5 μm and 4.0 μm)

The results of the current study were compared to established occupational exposure limits [Permissible Exposure Limits (PELs), Threshold Limit Values (TLVs), National Institute of Occupational Health Recommended Exposure Limits (NIOSH RELs)] for all of the contaminants listed above, with the exception of VOCs. VOC results were compared to established recommended exposure limits [(Minimal Risk Levels (MRL)]. All employee exposure to the above air contaminants and noise were well below established Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs) and other established recommended exposure limits.

The results from the current study were also compared with previous studies to evaluate trends in occupational exposure to Park Service personnel. Comparison of the current study with previous studies shows a general decrease in exposure to aldehydes, BETX, VOCs, and respirable particulate matter. The results of noise exposure received by Park Service Personnel were similar to those found in previous studies with the only area of noise concern being the riders of snowmobiles whose 8-hour TWAs exceeded the OSHA Hearing Conservation Amendment and approached the OSHA Engineering Standard.