

Gurdas Singh Sandhu, Ph.D.

Fellow, ORISE Research Program, US EPA

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Summary

Transportation (Onroad and Nonroad/Offroad Vehicles) - Energy Use, Alternative Fuels, Emissions, and Emissions Control Devices; Air Pollution and Air Quality; Energy and Environment Consulting; Technology and Business Development; Data Quality Assurance Methods; US EPA's MOVES model; Computer Based Data Acquisition Systems; LabVIEW Programming.

Education

- 2015 **Ph.D. in Civil Engineering**
North Carolina State University, USA
Dissertation: Evaluation of Activity, Fuel Use, and Emissions of Heavy-Duty Diesel and Compressed Natural Gas Vehicles
Advisor: Dr. H. Christopher Frey, Distinguished University Professor
- 2011 **M.S. in Environmental Engineering**
North Carolina State University, USA
Thesis: Methods for Quality Assurance of Portable Emissions Measurement System Data and Methods for Field Comparison of Alternative Fuels
Advisor: Dr. H. Christopher Frey, Distinguished University Professor
- 2001 **B.E. in Instrumentation Engineering**
Sant Longowal Institute of Engineering and Technology, India

Professional Experience

- 2015 – Fellow, ORISE Research Program, *United States Environmental Protection Agency (EPA)*
2008 – 14 Graduate Research Assistant, *North Carolina State University, USA*
2005 – 08 General Manager, Engineering Solutions, *Quantum Age Tech Solutions Pvt. Ltd. (QATSPL), India*
2003 – 05 Assistant General Manager, Engineering Solutions, *QATSPL*
2001 – 03 Systems Engineer, *QATSPL*

Professional Service

Chair: On & Off Road Mobile Sources Technical Coordinating Committee of the A&WMA. Vice-Chair for the same committee for 2015-2017.

Journal Reviewer: (1) Atmospheric Environment; (2) Transportation Research Part D: Transport and Environment; (3) Journal of the A&WMA; (4) Transportation Research Record, Journal of the Transportation Research Board (TRB) of the National Academies; (5) Resources, Conservation & Recycling; (6) SAE Technical Papers; (7) Journal of Infrastructure Systems; (8) International Journal of Sustainable Transportation

Member: (1) Emissions Measurement & Testing Committee of the Truck & Engine Manufacturers Association (EMA); (2) TRB; (3) A&WMA; (4) Society of Automotive Engineers (SAE); (5) American Society of Mechanical Engineers (ASME); (6) American Society for Testing and Materials (ASTM)

Patents

1. Miller, D. W.; Hynd, W. J.; **Sandhu, G. S.**; Burnette, A. D.; Ropkins, Karl. *Particulate Matter/Number Synchronization Measurement Device*. International Application Number PCT/US15/50950. Sep. 18, 2015. European Patent Office Application Number 15777775.6 – 1553, dated Sep. 18, 2015
2. Ropkins, K.; Miller, D. W.; Hynd, J. W.; Miller, J.; Pfister, C.; Burnette, A. D.; **Sandhu, G. S.** *Particulate Calibration and Generation Simulator for Particle Measurement and Number*. U.S. Provisional Patent Application No. 62/198,944. July 30, 2015.

Refereed Journal Papers

1. **Sandhu, G. S.**; Frey, H. C.; Bartelt-Hunt, S.; and Jones, E. Real-World Activity, Fuel Use, and Emissions of Diesel Side-Loader Refuse Trucks. *Atmospheric Environment*, 129: 98–104, 2016.
2. **Sandhu, G. S.**; Frey, H. C.; Bartelt-Hunt, S.; and Jones, E. In-Use Activity, Fuel Use, and Emissions of Heavy Duty Diesel Roll-off Refuse Trucks. *Journal of the Air & Waste Management Association*, 65 (3): 306–323, 2015.
3. **Sandhu, G. S.**; Frey, H. C.; Bartelt-Hunt, S.; Jones, E. In-Use Measurement of the Activity, Fuel Use, and Emissions of Front-Loader Refuse Trucks. *Atmospheric Environment*, 92: 557–565, 2014.
4. Hu, J.; Frey, H. C.; **Sandhu, G. S.**; Graver, B. M.; Bishop, G. A.; Schuchmann, B. G.; Ray, J. D. Method for Modeling Driving Cycles, Fuel Use, and Emissions for Over Snow Vehicles. *Environmental Science & Technology*, 48 (14): 8258–8265, 2014.
5. **Sandhu, G.S.**; Frey H.C. Effects of Errors on Vehicle Emission Rates from Portable Emissions Measurement Systems. *Transportation Research Record: Journal of the Transportation Research Board of the National Academies*, 2340: 10-19, 2013.
6. Boroujeni, B.Y.; Frey, H.C.; **Sandhu, G.S.** Road Grade Measurement Using In-Vehicle, Stand-Alone GPS with Barometric Altimeter. *Journal of Transportation Engineering of the American Society of Civil Engineers*, 139 (6): 605–611, 2013.
7. **Sandhu, G.S.**; Frey H.C. Real-World Measurement and Evaluation of Duty Cycles, Fuels, and Emission Control Technologies of Heavy-Duty Trucks. *Transportation Research Record: Journal of the Transportation Research Board of the National Academies*, 2270: 180-187, 2012.

Select Peer-Reviewed Conference Papers

1. **Sandhu, G.S.**; Frey, H.C. *Energy Use and Emissions from Diesel and Biodiesel Blends for Earthmoving Equipment*. Paper 2013-12833-AWMA, Proceedings, 106th Annual Conference and Exhibition, Air & Waste Management Association, Chicago, Illinois, June 2013.
2. Frey, H.C.; Boroujeni, B.Y.; Liu, B.; Hu, J.; Jiao, W.; Graver, B.M.; **Sandhu, G.S.** *Field Measurements of 1996 to 2013 Model Year Light Duty Gasoline Vehicles*. Proceedings, 106th Annual Conference and Exhibition, Air & Waste Management Association, Chicago, Illinois, June 2013.
3. Frey, H.C.; **Sandhu, G.S.**; Sun, Y.; Lee, T.; Swidan, H.; Liu, B.; Babae, S. *Incorporating Vehicle Portable Emissions Measurement Systems into the Classroom*. Paper 2011-A-146-AWMA, Proceedings, 104th Annual Conference and Exhibition, Air & Waste Management Association, Orlando, Florida, June 2011.

Select Recent Conference Presentations

1. **Sandhu, G. S.**; Sonntag, D. B.; Sanchez, J. *In-Use Emission Rates for MY 2010+ Heavy-Duty Diesel Vehicles*. 27th Annual Coordinating Research Council (CRC) Real World Emissions Workshop, Long Beach, California, March 2017
2. **Sandhu, G. S.**; Sonntag, D. B.; Hamady, F. *Effect of Driving Conditions on NO_x Emissions from 2010+ Heavy-Duty Vehicles*. 26th Annual Coordinating Research Council (CRC) Real World Emissions Workshop, Newport Beach, California, March 2016.
3. **Sandhu, G. S.**; Frey, H. C.; Bartelt-Hunt, S.; Jones, E. 2015. *Comparison of Real-World and MOVES Estimated*

Emissions for Heavy-Duty Diesel Refuse Trucks. 108th Annual Conference & Exhibition of the Air & Waste Management Association, Raleigh, North Carolina, June 2015.

4. Ropkins, K.; **Sandhu, G. S.**; Burnette, A. D. 2015. A Novel Multiplexed Sensor-Based Approach to Mobile Particle Mass and Number Measurement. 25th Annual Real World Emissions Workshop of the Coordinating Research Council, Long Beach, California, March 2015.
5. **Sandhu, G. S.**; Frey, H. C.; Bartelt-Hunt, S.; Jones, E. *Real-World Activity and Fuel Use of Diesel and Compressed Natural Gas Refuse Trucks*. PEMS International Conference and Workshop, CE-CERT, University of California-Riverside, April 2014.

Technical Reports

1. Frey, H.C.; **Sandhu, G.S.** Series of reports for the research project “Evaluating Air Emissions and Fuel Efficiency of Solid Waste Collection Vehicles”, funded by Environmental Research and Education Foundation. March 2012 to November 2013.
2. Ray, J.D.; Bishop, G.; Schuchmann, B.G.; Frey, C.; **Sandhu, G.**; Graver, B. *Yellowstone Over-snow Vehicle Emission Tests – 2012: Summary Vehicle Data and Fleet Estimates for Modeling*. Natural Resource Technical Report NPS/NRSS/ARD/NRTR—2013/661, National Park Service, U.S. Department of the Interior, Denver, Colorado, January 2013.
3. Frey, H.C.; **Sandhu, G.S.** *Comparison of Energy Use and Emissions for Three Wheel-Loaders Operated on Ultra Low Sulfur Diesel, B20 Biodiesel, and B35 Biodiesel*. Prepared by North Carolina State University for Greener by Design, New Brunswick, New Jersey, September 2012.
4. Frey, H.C.; **Sandhu, G.S.**; Graver, B.M.; Hu, J. *Measurement of Fuel Use and Emissions of Over-Snow Vehicles at Yellowstone National Park*. Prepared by North Carolina State University for Louis Berger Group, Denver, Colorado, September 2012.
5. Frey, H.C.; **Sandhu, G.S.** *Comparison of Fuel Use and Emissions of B-20 Fueled Combination Trucks with versus without a Fuel Additive*. Prepared by North Carolina State University for Hydrotex Partners Ltd., Farmers Branch, Texas, October 2011.
6. Frey, H.C.; **Sandhu, G.S.** *Comparison of Fuel Use and Emissions of B-20 Fueled Combination Trucks with versus without a Fuel Additive*. Prepared by North Carolina State University for Nanostar Advanced Technologies, Burlington, North Carolina, September 2009.
7. Frey, H.C.; Choi, H-W.; Graver, B.M.; **Sandhu, G.S.** *Energy Use and Emissions of a Locomotive Engine during Dynamometer Testing*. Prepared by North Carolina State University for North Carolina Department of Transportation, Raleigh, North Carolina, July 2009.

Industry Experience

2005 to 2008 **General Manager, Engineering Solutions**
Quantum Age Tech Solutions Pvt. Ltd., India
Responsibilities: Technology development and management, project supervision, customer feedback and relationship management, and business development.

- Led a team that developed the pre-processor and post-processor for Tire Noise Simulation Software. Implemented high-speed parsing and packaging of multi-million point arrays. Software allows tire noise estimates at the design stage, thereby significantly cutting prototyping cost, meet noise regulations, and provide competitive advantage by reducing design cycle duration.
- Led a team that developed software to implement Design of Experiments (DOE) based waveform analysis approach for locating defects in tire building process by using data from tire uniformity machine.
- Supervised design and development of software for gear “health” monitoring system for detection, identification and quantification of gear defects such as eccentricity, misalignment, backlash, broken tooth, and imbalance. This product won an award at the National Instruments India annual user conference in 2005.
- Conducted Failure Mode and Effects Analysis (FMEA) studies, for a pharmaceutical company, which involved a diverse group of stakeholders such as design, quality, production, finance, and marketing.

- Expanded business in overseas markets, specifically, sold the tire noise simulation software and coordinated software supply and technical support for a tire manufacturer in Malaysia.
- Negotiated exclusive India representation for bolted joint analysis software from a Lancashire, UK based company.

2003 Assistant General Manager, Engineering Solutions

to 2005 *Quantum Age Tech Solutions Pvt. Ltd., India*

Responsibilities: Manage project requirements including review of system specifications with customers, estimating project timelines and costs, technical development, and project delivery.

- Led a team in the development of Tire Extruded Rubber Offline Profilometer. Specs: PXI (PCI eXtensions for Instrumentation) bus architecture, dual laser non-contact measurement, real-time SQL Server data storage, 25 micron accuracy along gauge, and 10 micron accuracy along length. The product helped improve accuracy of extrusion die, reduce rubber waste, and reduce tire rejection at tire building stage. Product was delivered at 50% cost of similar imported system and achieved a return on investment in six months.
- Formulated a software coding model that improved hardware resource utilization, lean and efficient programming, and maintainable project structures.
- Established practices to bring fresh software development recruits to full productivity on live projects.
- Negotiated India representation for contact pressure imaging systems from a leading technology company based in Alberta, Canada.

2001 Systems Engineer

to 2003 *Quantum Age Tech Solutions Pvt. Ltd., India*

Responsibilities: Development of customized analog and digital data acquisition systems for PC based control.

- Implemented real-time data encapsulation and data storage schemes for high speed and long duration computer controlled data acquisition systems.
- Designed and developed an automotive clutch Bearing Endurance Testing System. Integrated a third party test rig with off-the-shelf electronics and custom software code. Post-processing of measurement data and statistical analysis helped the customer find out design robustness and identify causes of typical failure modes.
- Designed and developed a race dimensional measurement system for bearings. Recycled sensors and power supply from the existing manual measurement setup. Implemented software based noise filtering routines to handle high sensitivity and micron level precision measurements. The system allowed the user to archive full test data and perform statistical analysis. Achieved over 25% reduction in the testing time over existing system.
- Established a channel with a noise and vibration control company based in Illinois, USA to assist a leading research organization in India get dynamic material property characterization of their composite materials as per SAE J-1637 (Oberst Bar) standard.

Skills – Hardware and Software

- LabVIEW, including Report Generation, Database Connectivity, and Noise & Vibration Toolkits
- Machine controlled data acquisition on PXI, PCI, Serial, USB, and wireless platforms
- Operation, calibration, and maintenance of portable emissions measurement systems (PEMS)
- Advanced literature search & review skills; Zotero for citation and bibliography management
- Microsoft Windows OS and SQL Server – Installation and administrator level configuration
- ArcGIS 10.1 – Analysis of geospatial information