

ASHOK K. SINGH

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Academic Qualifications

B.Sc. - Physics, Mathematics, Statistics, 1968, Lucknow University, India

M.Sc. - Mathematical Statistics, 1970, Lucknow University, India

Ph.D. - Statistics, 1977, Purdue University, W. Lafayette, Indiana

Employment History

Time period	Position
01/2006 - Present	Professor, Hotel Management, UNLV, Las Vegas, Nevada
08/1993 – 12/2005	Professor, Department of Mathematical Sciences, UNLV, Las Vegas, Nevada
8/1991 - 8/1993	Associate Professor of Mathematics and Senior Statistician, Harry Reid Center for Environmental Studies, UNLV, Las Vegas
06/1990 - 12/1991	(leave of absence from NM Tech) Senior Statistician, Environmental Research Center, UNLV
08/1983 - 06/1991	Associate Professor of Mathematics, New Mexico Tech
06/1986 - 12/1986	(Sabbatical leave from NM Tech) Visiting Professor, Department of Statistics, Lucknow University, India
06/1977 - 05/1978	Visiting Research Scientist, National Institute of Environmental Health Sciences, Research Triangle Park, North Carolina

Consulting Experience:

A. Work with EPA-Las Vegas: During June 1990 - July 2003, I provided statistical/geo-statistical support to Superfund/RCRA projects of the U.S.EPA. Following is a partial listing of some of these sites:

Superfund Sites

Nature of Work	Superfund Site
Review of statistical and geo-statistical analyses	Leadville Site, Pease Air Force Base, Mottolo Air Force Base, Commodore Semi-conductor Group, Montrose Site, METCOA Site, Norwood Site.

Monitoring Design/ Geostatistical data Analysis including kriging	Oak Ridge (Poplar Creek/Clinch River), Sangamo Weston Inc., Allied Paper, Calwest Metals, National Zinc, Blackwell Zinc, California Gulch, South Indian Bend Wash, Brio, Aberdeen, Montrose Superfund Site, Columbia Nitrogen, Omaha Lead, Fort Ord, Chem Solve, Gibbsboro, ...
Statistical & Geostatistical Applications	Hunters Point Naval Shipyard, Cleveland Mills, Ashtabula River site, Western Sands & Gravel, Texarkana TEXWOOD Site, Chemsolve

RCRA Sites

Review of statistical and geo-statistical analyses	Gerald Metals, Southern California Chemicals, etc.
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B: Work with Local Agencies:

I have designed statistical experiments and performed data analysis for the Chlorophyll Sampling Project of Clark County Sanitation District (summer 1998), and also their Hydrogen Sulfide Project (2000).

C: Work with Business Organizations:

2001: I was retained by Mr. David W. Tundermann of Parsons Behle & Latimer, Salt Lake City, Utah to develop a sampling plan for their US v. MagCorp case. I had visited the MagCorp facility back in 2001 to take a look at the waste piles, and then had developed a statistical sampling plan.

July of 2002, I performed statistical data analysis for Southern Nevada water Authority (SNWA). This involved fitting different probability models to data provided by SNWA.

D: Litigation Support Work

1980's: (Client: Angel Fire Corporation) Angel Fire Corporation used to make artificial snow for its ski-resort, and was sued by local farmers for adversely affecting the water table. I had performed statistical data analysis (Analysis of Covariance – ANCOVA) on data provided to me by Angel Fire, and gave a deposition.

February 2002: (Client: A Las Vegas physician, represented by Ms. Morisa Schechtman, Esq.; tel 636-9200). I had to perform statistical data analysis of Airline Safety data provided to me by the client, and present a poster comparing the safety of General Aviation segment to that of Commercial Airlines in my testimony as an expert witness.

2002: I was retained by Mr. Jeffrey Orr, Esq. of Doyle, Berman & Boyack (Las Vegas law firm) to assist on a case of his client Kimble Mixer of Ohio (Kimble Mixer vs. Allstar Aggregate). Allstar Aggregates was suing Kimble Mixer, claiming that the cement mixer trucks sold by Kimble Mixer were of poor quality. I had to design a statistical experiment to determine if Allstar drivers consistently overloaded the cement mixer trucks which

caused the trucks to break down, collect data – which involved randomly selecting invoices from approximately 40 banker boxes, and determining the weights of concrete carried by the trucks. My statistical analysis of the data had shown that overloading did occur very frequently – this analysis was described in a report submitted to Mr. Jeffrey Orr. My deposition was taken on August 30, 2002. The case was settled in January 2005.

August 2004: I was retained by the Law Office of John Peter Lee, Ltd. to compare three periods of sales at a business (Pre-POS, POS1, POS2) in terms of profits. My deposition was taken in January 2005.

E: Statistical Analysis of casino Games:

I have mathematically analyzed a large number of casino games for local and non-local inventors, and have also verified mathematics of slot games developed by local slot manufacturers.

Book Published:

Andrew Cardno, Ashok K. Singh, Ralph Thomas (2011). THE MATH THAT GAMING MADE. Casino Services Publishing, ISBN 978-0-9848027-0-8

Articles in refereed journals

Statistical Theory and Methods:

Singh, A. K. (1977) "On Slippage Tests and Multiple Decision (Selection & Ranking) Procedures. Ph.D. Thesis. Purdue University Department of Statistics Mimeo Series # 494.

Singh, A. K. (1978) "Testing multiple slippages". The Canadian Journal of Statistics, 6, 201-218.

Singh, A. K. and Chi, P. Y. (1978) "On a test of homogeneity against slippage alternatives for binomial populations". Journal of the Chinese Statistical Association, 16, 6083-6089.

Bhattacharya, S. K. and Singh, A. K. (1979) "Life estimation after testing an early failure". Proc. of the Conference on Recent Developments in Statistical Methods and Applications, 31- 44 (Dec. 15-17, 1979, Taipei, Taiwan).

Gupta, S. S. and Singh, A. K. (1979) "On selection rules for treatment vs. control populations". The Proc. of the 42nd meeting of the International Statistical Institute, Manila (Dec. 1979).

Gupta, S. S. and Singh, A. K. (1980) "On rules based on sample medians for selection of the largest location parameter". Comm. in Statistics - Theory and Methods (A), 1277-98.

Vardeman, S. and Singh, A. K. (1981) "Empirical restricted Bayes rule in a multivariate discrete exponential family". Communications in Statistics - Theory and Methods (A), 79-100.

- Singh, A. K. and Singh, Anita (1983) "On estimation of mean life in the presence of an outlier". IEEE Transactions on Reliability, vol. R-32, 485-487.
- Singh, A. K. and Singh, Anita (1986) "On estimation of the prior density in the exponential case by numerical inversion of the Laplace transform". Integral Methods in Science and Engineering, Editors : F. R. Payne, C. C. Corduneanu, A. Haji- Sheikh, T. Huang, 149-155.
- Bhattacharya, S. K. and Singh, A. K. (1986) "Life estimation after testing for early failures". IEEE Trans. on Reliability, vol. R-35, 423-426.
- Singh, A. K. and Singh, Anita (1986) " On empirical Bayes estimation of mean life for the constant hazard rate model". IEEE Trans. on Reliability, vol. R-35, 399-402.
- Pathak, P. K., Zimmer, W., Singh, A. K., and Singh, Anita (1987) "Empirical Bayes estimation of mean life from an accelerated life test". Journal of Statistical Planning and Inference, vol 16, 353-363.
- Srivastava, V.K. and Singh, A.K.(1987) "A class of estimators for the linear calibration problem". Symposium Proceedings of the Joint Statistical Meetings of the American Statistical Association & the Biometric Society (Conference held in San Francisco, Aug. 17-20, 1987).
- Singh, A.K. (1987) "Bayes rules for selection of populations closest to control". Ramanujam Memorial Volume of the Indian Journal of Mathematics, Vol. 29, pp. 321-333.
- Singh, A.K., Singh, Anita, and Zimmer, W.J.(1988) "A non- parametric empirical Bayes decision function for mean life". Proceedings 1988 Annual Meeting, Decision Sciences Institute, November 21-23, 1988, Las Vegas, Nevada, pp. 135-137.
- Dey, Anita Singh, Ashok Singh (1988). "Estimation of series system reliability for exponentially distributed component life times". Microelectronics & Reliability, Vol. 28, pp. 909- 917.
- Pandey, Ashok Singh, W. J. Zimmer(1993). "Bayesian estimation of the linear hazard rate model". IEEE Transactions on Reliability, Vol. 42, 636-640.
- Singh, A.K. and Singh, Anita(1990)."A methodology for computation of the exact distribution for an acceptance testing procedure for a parallel system". 1990 Integral Methods in Science and Engineering Conference Proceedings, University of Texas at Arlington.
- Bhattacharya, S.K., Pandey, Alok, and Singh, A.K.(1990)."A comparison of some approximate methods of computing Bayes estimators". 1990 Integral Methods in Science and Engineering Conference Proceedings, University of Texas at Arlington.
- Bayesian estimation of hazard and acceleration in accelerated testing (with P.K. Pathak and W.J. Zimmer), IEEE Transactions on Reliability, Dec. 1991.

- Estimation of a Composite Hazard-Rate Model (with M.M.A. Ananda), *Journal of Microelectronics and Reliability*, VOL 33, 1993: 2013-2019.
- Rank Kriging: An Alternative Nonparametric Geostatistical Method (with M.M.A. Ananda and A.R. Sparks), *Analytica Chimica Acta*, 277 (1993) p. 503-510.
- A Bayesian Slippage Test for Outlying Sub-samples (with Anita Singh), *Analytica Chimica Acta*, 277 (1993) p. 473-475.
- Bayesian Confidence Interval for the Product of Three Normal Means (with M.M.A. Ananda and G.Flatman), *Analytica Chimica Acta*, 277 (1993) p. 503-510.
- Estimation of Background Levels of Contaminants (with Anita Singh and G.T. Flatman). *Int. Journal of Math Geology*, 1994, Vol. 26, No. 3, p. 361.
- Trend Removal in Spatially Correlated Datasets (with Anita Singh). *Mathematical Geology*, Vol. 28, 1996, 111-132.
- The Lognormal Distribution in Environmental Applications (with Anita Singh, Max Engelhardt). EPA Technology Support Center Issue Paper, Las Vegas, EPA/600/R-97/006, December, 1997.
- Computation of Optimal Bayesian Credible sets for the Binomial and the Poisson distributions (with L.P. Gewali, S. Ntafos). *Boundary Element Technology XIII*, June 1999, pp.397-406.
- Singh, A. K., Singh, Anita, Engelhardt, M.; Some Practical aspects of sample Size and Power Computations for Estimating the Mean of Positively Skewed Distributions in Environmental Applications; EPA/600/s-99/006, November.
- Singh, A. K., Gewali, L. P. (1998); An Algorithm for Computing Optimum Moving Average Length with Applications in Predicting Housing Demand. *International Journal of Business Research*, Vol. V, No. 1, p. 64-75.
- Pandey, A., Singh, A. K. (2000) A Bayes test of homogeneity of several means for one parameter exponential populations), *Applied mathematics and computations*, Vol. 108, pp. 23-32.
- Dalpatadu, R., Gewali, L. P., and Singh, A. K.; Computing Bayesian highest posterior density credible sets for the lognormal mean; *Environmetrics*, 2002, Vol. 13, 465 – 472.
- Dalpatadu, Rohan J. and Singh, Ashok K. (2008). A numerical method for computing the probability distribution of a finite sum of independent nonnegative random variables. *Advances and Applications in Statistics*, Vol. 9, No. 1, pp. 145-152.

Khago, Ahmed; Singh, Ashok K.; Gewali, Laxmi P. (January 2011). Bayesian Estimation of the Normal Mean from Censored Samples. Accepted for publication in the Conference Proceedings of the 8th International Conference on **Information Technology:New Generations**, Las Vegas, Nevada (Paper ID: 1634615).

Engineering Applications:

Singh, A. K. (1981) "A discussion of Optimizing Pipeline Operations". Journal of Petroleum Technology, 1403-1404.

Singh, A. K. and Torma, A. E. (1981) "An application of weighted least squares in the analysis of uranium leaching data". New Mexico Journal of Science, vol. 21, 8-11.

Torma, A. E., Santana, J. J. and Singh, A. K. (1981) "A novel approach to tailings disposal". Proceedings of the 5th Annual Uranium Seminar of AIME, Albuquerque, New Mexico.

Singh, A. K., Torma, A. E. and Rossi, G. (1982) "Optimization of Zinc extraction from sphalerite by Thiobacillus ferrooxidans" Resoconti Della Associazione Mineraria Sarda Iglesias, Cagliari, Italy, 1-27.

Chutinara, D., Torma, A. E. and Singh, A. K. (1984) "Leaching of a uranium ore with sulfuric acid and Oxone". Metall, 121-126.

Torma, A. E., Garcia, H. and Singh, A. K. (1986) "Lithium extraction from a complex Lepidolite ore by pressure leaching with sodium carbonate", Proc. of the Reinhardt Schuhmann International Symposium, The Metallurgical Society, Inc., 989- 1001.

Garcia, H., Torma, A. E., Block-Bolten, A. and Singh, A. K. (1986) "Sodium carbonate pressure leaching of a New Mexico complex Spodumene ore". Light Metals, The Metallurgical Society, Inc., Editor : R. E. Miller, 1001-1008.

Jiang, H., Lee, K.H., Singh, Anita, Singh, A.K., Torma, A.E.(1988) "Kinetics of Gallium and Germanium Extraction from a complex ore by H₂SO₄ - Na₂S₂O₃ leachants". Precious and Rare Metal Technologies - Process Metallurgy 5, Elsevier Press, New York, pp. 547-565.

Singh, A.K, Singh, Anita, Torma, A.E. (1988) "A statistical approach to kinetic evaluation of gold ore leaching data". Precious and Rare Metal Technologies - Process Metallurgy 5, Elsevier Press, New York, pp. 263-279.

Miller, D. and Singh, A.K.(1990)."Exact distribution of the least-squares estimator of the linear stress failure model" 1990 Integral Methods in Science and Engineering Conference Proceedings, University of Texas at Arlington.

An Efficient Method for Generating Random Fields (with S.G. Ghori and J.P. Heller. Math Geology, 1993 v25 n5: 559- .

- An Efficient Method for Detecting Plume Concentration in Aquifers (with S.G. Ghori and J.P. Heller), *Environmetrics journal*, 1992, p. 150-166.
- A Bayesian Reliability Approach to the Performance Assessment of a Geological Waste Repository (with J. A. Flueck), *Proceedings of the High-Level Radioactive Waste Management Conference*, held in Las Vegas, Nevada, April 1992.
- Acidolysis of Fly Ash by *Aspergillus niger* (with A. Torma), *FUEL*, Dec. 1993, v72 n12: 1625- .
- Radioactive Contaminant transport in Fractured Porous Media: An Analytical Solution (with G. S. Singh, R. Dalpatadu. *Boundary Element Technology XIII*, June 1999, pp.35-41.
- Determination of the Optimal Mixture Distribution (with I. Farnham, K. Johannesson). *Boundary Element Technology XIII*, June 1999, pp.430-436.
- Performance Assessment of Multiple Engineered Barrier Systems (with M. M. A. Ananda), *Applied mathematics and Computation*, Vol 102, 1999, pp. 25-33.
- Hechanova, A. E., Singh, A. K. (1999). Comments on Performance Assessment in Support of the 1996 Compliance Certification Application for the Waste Isolation Pilot Plant, *Risk Analysis*, Vol. 19, No. 5, p. 987.
- Farnham, Irene, Stetzenbach, K. J., Singh, A. K., Johanneson, K. H., (2000). Deciphering Groundwater Flow Systems in Oasis Valley, Nevada using Trace Element Chemistry, Multivariate Statistics, and GIS; *Mathematical Geology*, Vol. 32, pp. 943 - 968.
- Farnham, Irene, Stetzenbach, K. J., Singh, A. K., Johanneson, K. H.(2002) ; Treatment of nondetects in multivariate analysis of groundwater chemistry data, *Chemometrics and Intelligent Laboratory Systems*, Vol. 60, 265-281.
- Singh, A. K. and Ananda, M. M. A.; Rank Kriging for Characterization of Mercury Contamination at the East Fork Poplar Creek, Oak Ridge, Tennessee; *Environmetrics*, 2002, Vol. 13, 679 – 691.
- Schultz, B., Singh, A. K., Singh, A. Evaluation of the confidence removal goal approach for making remediation decisions at Metcoa Superfund Site; *Environmetrics*, 2002, Vol. 13, 725 – 732.
- I. M. Farnham, K. H. Johanneson, A. K. Singh, V. F. Hodge, K. J. Stetzenbach. “Factor analytical approaches for evaluating groundwater trace element chemistry data”. *Analytica Chimica Acta* (2003), 123-138.
- Lucas, A.F., Dunn, W.T., & Singh, A.K. (2005). Estimating the Short-term Effect of Free-play Offers in a Las Vegas Hotel Casino. *Journal of Travel and Tourism Marketing*., Vol. 18, p. 53-68.

- Glenn Tootle, Thomas Piechota, Ashok Singh (2005). Coupled oceanic-atmospheric variability and U.S. streamflow. *Water Resources Research*, W12408, doi:10.1029/2005WR004381.
- Glenn Tootle, Ashok Singh, Thomas Piechota, Irene Farnham (2007). Long Lead-time Forecasting of U.S. Streamflow using Partial Least Squares Regression. *ASCE Journal of Hydrologic Engineering*, pp. 442-451
- S. H. Lee, A. K. Singh, L. P. Gewali (2008). Dimension Reduction for Performing Discriminant Analysis for Microarrays. *Computational Intelligence in Medical Informatics” Series: Studies in Computational Intelligence*, Vol. 85, Editors: Arpad Kelemen, Ajith Abraham, Yulan Liang; Approx. 390 p., Hardcover; ISBN: 978-3-540-75766-5.
- Shlayan, Neveen, Venkat., Rama, Ginobbi, Paolo and Singh, Ashok K. (2009). Energy Efficient RGBW Pixel Configuration for Light-Emitting Displays. *Journal of Display Technology*, Vol. 5, No. 11, November 2009, pp. 18 – 24.
- S. Ghosh, J. Brown, M. Zeko, A.K. Singh, M. Finch (2012). Evaluation of a New Field Screening Tool for Chlorinated Solvent Impacted Site Investigations - A Case Study. *Association of Environmental & Engineering Geologists (AEG) News*, March 2012, pp. 26-28.
- Jeffrey Saad Jumaily, MD, Christine Fayad, Vartan Mardirossian, MD, Ashok Singh, PhD, John Stram, MD, and Spiegel, Jeffrey, MD. (2012). Preoperative Incidence of Olfactory Dysfunction in Nasal Surgery Patients. *Otolaryngology -- Head and Neck Surgery*, pp. 157-160.

Hospitality Research

- A. F. Lucas, A. K. Singh, L. P. Gewali (2007). Simulating the Effect of Pay Table Standard Deviation on Pulls Per Losing Player at the Single-visit Level. *UNLV Gaming Research & Review Journal*, Vol. 11, pp. 41 – 52.
- Lucas, Anthony; Singh, A. K. (2008). Decreases in a Slot Machine's Coefficient of Variation Lead to Increases in Customer Play Time. *Cornell Hospitality Quarterly* 2008; 49; 122-133.
- Singh, Ashok K., Singh, Anita, Gewali, Laxmi P. (2008). Spatial Population Partitioning Using Voronoi Diagrams for Environmental Data Analysis. *International Journal of Applied Environmental Sciences*, Pp. 75-96.
- Timilsena, Janak, Piechota, Glenn, Tootle Thomas, and Singh, Ashok (2009). Associations of Interdecadal/Interannual Climate Variability and Long-Term Colorado River Basin Streamflow. *Journal of Hydrology*. Volume 365, Issues 3-4, 25, pp. 289-301
- Lucas, Anthony; Singh, A. K.; Gewali, L.P.; Singh, A (2009). An Application of Spatial Population Partitioning Using Voronoi Diagrams: Principal Component Regression

Analysis of Slot Machine Performance Data. *Journal of Travel and Tourism Marketing*, 26: 415 – 429.

Vasudevan, Vinod ; Nambisan Shashi S.; Singh, Ashok K.; Pearl, Traci (2009). Effectiveness of Media and Enforcement Campaigns in Increasing Seat Belt Usage Rates in a State with a Secondary Seat Belt Law. *Traffic Injury Prevention*. Vol. 10 (4), pp. 330 – 339.

Ahlgren, Mike, Dalbor, Michael, Singh, Ashok K Estimating the effects of the 2003 gaming tax restructuring on riverboat gaming volume. October 2009.

Singh, Ashok K., Gewali, Laxmi P. (2010). A Shape-Similarity Index for Stiff Diagrams. *International Journal of Applied Environmental Sciences*, Vol 5, pp. 541-552.

Green, John; Kaseko, Mohamed; Singh, Ashok; Roberts, Brian (December 2010). Development of Trip Production Models Incorporating Disaggregate Accessibility Measures Developed Through Use of GIS, submitted to *The Journal of Advanced Transportation* (manuscript ID is ATR-10-0197).

Jeffrey Spiegel , John Stram , Christine Fayad BS, Jeffrey Saad Jumaily, Vartan Mardirossian , Ashok Singh. (2011). Pre-operative Incidence of Olfactory Dysfunction in Nasal Surgery Patients. Paper submitted to *The Archives of Facial Plastic Surgery*.

Ahlgren, Mikael; Dipendra Singh; Singh, Ashok K. Cross-State Substitution: Estimating the effect of the 2003 Illinois gaming tax restructuring on Indiana riverboat gaming volume in the Chicagoland region.

Abarbanel, Brett L.L. ; Lucas, Anthony F.; Singh, A. K. (2011). Estimating the Indirect Effect of Sports Books on Other In-House Gaming Volumes. Paper submitted to the *Journal of Business Research's Special Issue on Gambling Theory, Research, and Practice*.

Suh, Eunju; Tanford, Sarah; Singh, Ashok (2011). The Indirect Gaming Contributions of Cash and Comped Casino Dining: Does Providing Complimentary Meals Pay Off at the Slots? Submitted to the *Journal of Travel and Tourism Marketing*.

Anthony F. Lucas and A. K. Singh (2011). Estimating the Ability of Gamblers to Detect Differences in the Payback Percentages of Reel Slot Machines: A Closer Look at the Slot Player Experience, *UNLV Gaming Research & Review Journal* (Volume 15, 2011; pages 17 - 36).

Above research article was featured in *Las Vegas Sun*, Wednesday, May 11, 2011, and also on KNPR Nevada Public Radio:

<http://www.lasvegassun.com/news/2011/may/11/study-challenges-slot-machine/>

<http://www.knpr.org/son/archive/detail2.cfm?SegmentID=7857&ProgramID=2234>

- Singh, A. K., Dalpatadu, R. and Lucas, A. F. (2011). The Probability Distribution of the Sum of Several Dice : Slot Applications. UNLV Gaming Research & Review Journal. Vol.15, Issue 2, pp. 109-118.
- Suh, Eunju, Tanford, Sarah, and Singh, Ashok (2011). The Indirect Gaming Contributions of Cash and Comped Casino Dining: Does Providing Complimentary Meals Pay Off at the Slots? To appear in the International Journal of Hospitality Management.
- Kalargyrou, V., Singh, A.K., and Lucas, A. (2012). Estimating the effect of racino restaurant sales on slot wagering volume. International Journal of Contemporary Hospitality Management, Vol. 24 Iss: 7, pp.1088 - 1099.
- Eunju Suh; Sarah Tanford; Ashok Singh (2012). The indirect gaming contributions of cash and comped casino dining : does providing complimentary meals pay off at the slots? International journal of hospitality management. - Amsterdam [u.a.] : Elsevier, ISSN 0278-4319, ZDB-ID 10742645. - Vol. 31.2012, 4, p. 1303-1310.

Articles in trade magazines

- Singh, A.K. and Cardno, Andrew . The Demise of the Slot Manufacturer. Casino Enterprise Management, July 2008.
- Singh, A.K. and Cardno, Andrew . Gaming: An Endless Fountain of Cash?. Casino Enterprise Management, August 2008, pp. 14 – 16.
- Singh, A.K. and Cardno, Andrew . The Petabyte Era of Gaming Data. Casino Enterprise Management, September 2008.
- Singh, A.K. and Cardno, Andrew . Gaming 2018: Searching for a Simpler World. Casino Enterprise Management, October 2008, pp. 14 – 18.
- Singh, A.K. and Cardno, Andrew . The Math That Gaming Made. Casino Enterprise Management, November 2008, pp. 20 – 24.
- Lewin, Bart, Singh, A.K. and Cardno, Andrew . Let's Talk Turkey: Applying Retail Market Basket Analysis to Gaming. Casino Enterprise Management, December 2008, pp. 10 – 14.
- Lewin, Bart, Singh, A. K., Cardno, Andrew. Market Basket Analysis II: Recovering Mr. Benedict's Money. Casino Enterprise Management, January 2009, pp. 16 – 18.
- Lewin, Bart, Singh, A. K., Cardno, Andrew. Market Basket Analysis III: Using Demographics and Spatial Information. Casino Enterprise Management, February 2009, pp. 10 – 15.

- Singh, A.K. and Cardno, Andrew. Smashing Boundaries with Internet Protocol. Casino Enterprise Management, March 2009, pp. 42 – 45.
- Singh, A.K. and Cardno, Andrew. Turning Market Basket Analysis into Action. Casino Enterprise Management, May 2009, pp. 20 – 23.
- Singh, A.K. and Cardno, Andrew. Golden Gate in 2008: How Golden Gate Casino is Dealing with Recession. Casino Enterprise Management, July 2009, pp. 44 – 47.
- Singh, A.K. and Cardno, Andrew. Who is Due Back? Part I. Casino Enterprise Management, August 2009, pp. 10 - 16.
- Singh, A.K. and Cardno, Andrew. Who is Due Back? Part II – Taking A Closer Look at a Sacred Cow. Casino Enterprise Management, September 2009, <http://www.casinoenterprisemanagement.com/articles/september-2009/who-due-back-part-ii>.
- Singh, A.K. and Cardno, Andrew. Who is Due Back? Part III – A Closer Look at Theoretical Win. Casino Enterprise Management, October 2009, pp. 14 - 18
- Singh, A.K. and Cardno, Andrew. Who is Due Back? Part IV – Applying BI to Measure Marketing Results . Casino Enterprise Management, November 2009, pp. 22 – 26.
- Singh, A.K. and Cardno, Andrew. Gaming Interactions That Drive Profits. Fuzzy Spatial Association and Gravity Modeling. Casino Enterprise Management, December 2009, pp. 16 – 20.
- Singh, A.K. and Cardno, Andrew. Why Do I Need Math? Pt. I: Does a 25% Rebate Actually Equal 25%?. Casino Enterprise Management, January 2010.
- Singh, A.K. and Cardno, Andrew. Why Do I Need Math? Pt. IV: A Second Look at the Rebate on Loss Formula. Casino Enterprise Management, March 2010.
- Singh, A.K.; Cardno, Andrew; Gewali, Anjan. The Long and Short of It: Slot Games from a Player’s Perspective. Casino Enterprise Management, April 2010.
- Singh, A.K.; Cardno, Andrew; Gewali, Anjan. Why Do I Need Math? Pt. V: Skewness and the Player Experience. Casino Enterprise Management, May 2010.
- Singh, A.K.; Cardno, Andrew; Gewali, Anjan. Perspectives of Data: Financial vs. Slots vs. Marketing. Casino Enterprise Management, June 2010.
- Cardno, Andrew; Singh, A. K.; Thomas, Ralph. Gaming Floors of the Future, Part 1: Downloadable Games. Casino Enterprise Management, July 2010.

Gaming Floors of the Future, Part II: The Download on Free Play, Casino Enterprise Management, August 2010.

Cardno, Andrew; Singh, A. K.; Thomas, Ralph. Gaming Floors of the Future, Part III: Can Multi-Theme Slots Change Players. Casino Enterprise Management, September 2010.

Cardno, Andrew; Singh, A. K.; Thomas, Ralph . Gaming Floors of the Future, Part IV: Can Multi-Theme Slots Change Players, Part II. Casino Enterprise Management, October 2010.

Cardno, Andrew; Singh, A. K.; Thomas, Ralph . Gaming Floors of the Future, Part V: An Analyst's Guide to Slot Floor Optimization. Casino Enterprise Management, November 2010.

Cardno, Andrew; Singh, A. K.; Thomas, Ralph; Evans, Jada . Gaming Floors of the Future, Part VI: Mini Casinos Meet Mini Games at Penny Alley—A Case Study of Silverton Casino, Pt. 1 of 2. Casino Enterprise Management, December 2010.

Cardno, Andrew; Singh, A. K.; Thomas, Ralph; Evans, Jada . Gaming Floors of the Future, Part VII: Mini Casinos Meet Mini Games at Penny Alley—A Case Study of Silverton Casino, Pt. 1 of 2. Casino Enterprise Management, January 2011.

Technical Reports:

1. Debris Analysis of Five Magazine Tests (1987) (with Anita Singh and Deborah Reichman). Prepared for Naval Surface Weapons Center, NMT/TERA No. T-87-1691-U.
2. Comparison of Missile Performance (1987). Prepared for TERA, New Mexico Tech.
3. Klotz Debris Analysis (1987) (with Anita Singh, Javon Evanoff, Deborah Reichman). Prepared for Naval Surface Weapons Center, NMT/TERA No. T-87-1683-U.
4. Experimental Designs for Screen Print Quality Based on Attribute Data (1989). Prepared for Digital Equipment Corporation, Albuquerque.
5. Bayesian Estimation of Reliability of Series and Parallel Systems (1989). Prepared for TRW Space and Technology Group, California.
6. A Study of Techniques for Integrating Components in a Performance Assessment Model of a High-Level Radioactive Waste Repository (1990) (with J.A. Flueck and W.J. Zimmer). Prepared for Electric Power Research Institute (EPRI), California.
7. Geostatistical Analysis of PCB Data from Sediment Samples Collected from the Ashtabula River, Fields Brook NPL Site (with D. Gonzales and J.A. Flueck),

- EPA\EMSL-LV Tech Report #EMSL-LV TSC-1, April 1991.
8. A Statistical Procedure for A Problem Arising in Groundwater Remediation, Western Sand and Gravel NPL Site, EPA\EMSL-LV Tech Report #EMSL-LV TSC-3.1, June 1991.
 9. Geostatistical Assessment of Cleveland Mill Data from the Analysis of Soils by Wavelength Dispersive X-Ray Fluorescence Spectrometry (with J.K. Rosenfeld, D. Gonzales, P.A. Malley, D.C. Hillman, D.M. Boyer, W.H. Cole, C.A. Kuharic, G.A. Raab, and R.E. Enwall), EPA\EMSL-LV Tech Report #EMSL-LV TSC-11, August 1991.
 10. X-ray Fluorescence Site Screening and Geostatistical Analysis of Soil Lead Data from the Cal West Metals NPL Site (with W.H. Cole, D. Gonzales, C.A. Kuharic), EPA\EMSL-LV Tech Report #EMSL-LV TSC-11, December 1991.
 11. Demonstration Plan for Field Technology(s) Analysis of PCBs at the Allied Paper/Portage Creek/Kalamazoo River Superfund Site (with Mark Silverstein of LESC, Las Vegas), Draft Report.
 12. Characterization of Mercury Contamination at the East Fork Poplar Creek Site, Oak Ridge Tennessee, A Case Study, (with C. L. Gerlach, D. Dobb, E. Miller, D. Carenas, D. Page, D. Combs, and E. M. Heithmar), EPA/600/R-95/110, August 1995, U.S.EPA, Office of Research & Development, Washington D.C.
 13. Jacobsen, E., Singh, A. K. (1999). NRAMP Comments on "Proposed methods for Incorporating lateral Diffusion into the PA for the TRU wastes in the GCD Boreholes (W. Beyler, August 23, 1999)", Letter report, Harry Reid Center for Environmental Studies, UNLV, September 30.
 14. Hechanova, A. E., Singh, A. K. (1999). NRAMP Comments on "3.0 Performance Assessment Methodology (David Gallegos, February, 1999)", Letter report, Harry Reid Center for Environmental Studies, UNLV, February 24.
 15. Hechanova, A. E., Singh, A. K. (1999). Estimation of Tritium Concentration in Nuclear Test Cavities at the Nevada Test Site. Internal Report, Harry Reid Center for Environmental Studies, UNLV, February 10.
 16. Anita Singh, Ashok K. Singh, Dennis Murphy(2009). Statistical Evaluation of Multi-Increment Sampling (MIS) or Increment Sampling (IS) Methodology and their Applicability in Addressing Various Project Objectives of Environmental Investigations. July 20, 2009.

Book Reviews

My Reviews on the following books have been published in Technometrics (1987-2009):

1. Metric Methods for Analyzing Partially Ranked Data, by D.C.Kritchlow.
2. Properties of Estimators for the Gamma Distribution, by K.O. Bowman and L.R. Shenton.

I have also reviewed the following books:

1. Analysis of Customer Satisfaction Data, by Derek R. Allen and Tanniru R. Rao.
2. Introduction to Data Mining, by Patricia B. Cerrito.
3. Model-based Geostatistics by Peter J. Diggle and Paul J. Ribeiro Jr.
4. Introductory Time Series with R. by Paul S. P. Cowpertwait and Andrew V. Metcalfe (currently reviewing this book, July 2009).
5. Model-based Geostatistics, by Peter J. Diggle and Paulo J. Ribeiro, Jr., Springer, 2007, ISBN 0- 387-32907-2, xiii+228pp.

BOOK PUBLISHED.

Andrew Cardno, Ashok K. Singh, Ralph Thomas (2011). The Math That Gaming Made. Published by Casino Services Publishing, LLC.

SOFTWARE DEVELOPMENT

- 1. ProUCL (developed in collaboration with Lockheed-Martin, Las Vegas for the U.S. EPA – Las Vegas)** - written in Object Oriented C++; the software is currently being reviewed by the U.S. EPA. The software computes Upper Confidence Limit (UCL) using several parametric and non-parametric approaches, and is extremely useful when the data distribution is highly skewed. This software is already being used by Project Managers of Superfund sites for making remediation decisions. At present, we are adding UCL computation for samples with non-detects.
- 2. Work in progress on Software for SPATIAL POPULATION PARTITIONING** – joint work with Dr. Laxmi Gewali (Department of Computer Science, UNLV) and Dr. Anita Singh (Lockheed-Martin, Las Vegas) – this software combines the method of population partitioning (Singh, Singh, Flatman – Math. Geol., 1994, p. 361 -) and a method from computational geometry, called the Voronoi diagram . The program is written in JAVA; the statistical method and software provides an alternative geostatistical alternative to Kriging. A paper has been submitted.

3. Software for multivariate data analysis SCOUT (developed in collaboration with Lockheed-Martin, Las Vegas for the U.S. EPA – Las Vegas), July 2009.

Professional Papers Presented:

- Torma, A. E., Eligwe, C. A., Kirby, D., Pendelton, N. R., Santana, J., and Singh, A. K. (1981) "Extraction of uranium from a low grade ore". 28th Congress of the International Union of Pure and Applied Chemistry, Vancouver, B.C., Canada.
- Singh, A. K., Torma, A. E., and Singh, Anita (1982) "Computation of uranium extraction rates from experimental data". New Mexico Academy of Science (NMAS) meeting, Socorro, NM. NM Jour. of Science, Vol. 23, pp. 33-41.
- Singh, A. K., and Torma, A. E. (1982) "Optimization of extraction of Zinc from sphalerite by Thiobacillus ferrooxidans". 58th annual meeting of the SWARM-AAAS, University of Texas, El Paso.
- Singh, A. K. and Singh, Anita (1983) "Empirical Bayes estimation in life testing". SW Regional meeting of the Mathematical Association of America, Socorro, NM.
- Singh, A. K., Singh, Anita, and Torma, A. E. (1983) "A statistical approach to kinetic evaluation and optimization". 6th International Symposium on Environmental Biogeochemistry, Santa Fe, NM.
- Singh, Anita, Singh, A. K., and Torma, A. E. (1983) "statistical analysis of kinetic results". NMAS meeting, Albuquerque, NM.
- Singh, A. K., Chia, L. M., and Torma, A. E. (1983) "Bacterial leaching of a uranium ore and determination of optimum experimental conditions". NMAS meeting, Albuquerque, NM.
- Monteiro, O. R., Torma, A. E., and Singh, A. K. (1983) "Relationship between O₂-mass transfer and copper extraction from a chalcopyrite concentrate by Thiobacillus ferrooxidans". SWARM- AAAS meeting, Utah State University.
- Singh, A. K., Torma, A. E., and Singh, Anita (1984) "Determination of kinetic parameters - a statistical approach". 60th annual meeting of the SWARM-AAAS, Texas Tech University, Lubbock, Texas.
- Singh, Anita and Singh, A. K. (1984) "Application of non- linear programming in constrained regression problems" 60th annual meeting of the SWARM-AAAS, Texas Tech University, Lubbock, Texas.
- Fisher, R., Singh, A. K., and Singh, Anita (1984) "Parameter estimation using the Kolmogorov-

- Smirnov distance". NMAS meeting, Clovis, NM.
- Singh, Anita and Singh, A. K. (1984) "A comparative study of the various methods of estimation of kinetic constants of the Michaelis-Menten equation". NMAS meeting, Clovis, NM.
- Singh, A. K. (1984) "Fitting equations to data". Department of Hydrology Symposium, New Mexico Tech, Socorro, NM.
- Pathak, P. K., Zimmer, W., Singh, A. K., and Singh, Anita (1984) "Empirical Bayes estimation of mean life from an accelerated life test". International Conference on Reliability and Quality Control, University of Missouri-Columbia.
- Singh, Anita and Singh, A. K. (1985) "A test of equality of the scale parameter for exponentially distributed life times". 61st annual meeting of the SWARM-AAAS, Tucson, Arizona.
- Singh, A. K. and Singh, Anita (1985) "Confidence interval estimation of the rate and order of a chemical reaction". 61st annual meeting of the SWARM-AAAS, Tucson, Arizona.
- Singh, A. K. and Singh, Anita (1985) "On estimation of the prior density of the mean life by numerical inversion of the Laplace transform". 1st International Conference on Integral Methods in Science and Engineering, University of Texas at Arlington.
- Singh, A. K. and Singh, Anita "Estimation of kinetic parameters by least absolute deviation regression and minmax regression". 62nd annual meeting of the SWARM-AAAS, University of Colorado, Boulder.
- Dey, D., Singh, Anita, and Singh, A. K. (1986) "Estimation of series system reliability for exponentially distributed component life times". 62nd annual meeting of the SWARM-AAAS, University of Colorado, Boulder.
- Singh, Ashok and Singh, Anita (1987) "Linear empirical Bayes estimation of mean life for constant hazard rate model". Joint national meeting of the Operations Research Society of America and the Institute of Management Sciences, St. Louis, October 25-28, 1987.
- Zimmer, W.J., Salazar, K, and Singh, A.K "Estimation of burn-in parameters", ORSA-TIMS Joint National Meeting, October 1988, Denver, Colorado.
- Pandey, Alok, Singh, A.K., and Zimmer, W.J. "Bayesian estimation of the linear hazard function model", ORSA-TIMS Joint National Meeting, October 1988, Denver, Colorado.
- S. K. Bhattacharya, A. Pandey, Ashok Singh "A comparison of some approximate methods of computing Bayes estimators". Second International Conference on Integral Methods in Science and Engineering, University of Texas at Arlington, May 1990.
- Ashok Singh, Anita Singh. "Exact distribution for an acceptance testing procedure for a parallel

- system". Second International Conference on Integral Methods in Science and Engineering, University of Texas at Arlington, May 1990.
- Miller, D. and Singh, A.K. "Exact distribution of the least-squares estimator of the linear stress failure model". Second International Conference on Integral Methods in Science and Engineering, University of Texas at Arlington, May 1990.
- An Efficient Method for Generating Random Fields (with S.G. Ghori and J.P. Heller), presented at the International Conference on Finite Fields, Coding Theory, and Advances in Communications and Computing, University of Nevada, Las Vegas, August 1991.
- An Efficient Method for Detecting Plume Concentration in Aquifers (with S.G. Ghori and J.P. Heller), presented at the 3rd International Conference on Environmetrics, Wisconsin, October 1991.
- Spatial Interpolation and GIS in Nonstandard Setting (with J.A. Flueck), presented at the 3rd International Conference on Environmetrics, Wisconsin, October 1991.
- A Nonparametric Procedure for Testing Effectiveness of Natural Attenuation in Ground Water Quality Monitoring (with J.A. Flueck), presented at the 3rd International Conference on Environmetrics, Wisconsin, October 1991.
- The Role of Statistics in Environmental Assessment, presented at the Mini-symposium on Statistics organized by the Department of Mathematics and Statistics, University of New Mexico, Albuquerque, December 1991.
- Case Studies of Geostatistical Sampling Design, presented at the Clinch River Environmental Restoration Program Meeting of the Oak Ridge National Labs: "Design for Sediment and Fish Sampling", March 1992.
- Acidolysis of Fly Ash by Aspergillus niger (with A. Torma), presented at the Third International Symposium on the Biological Processing of Coal, Florida, May 1992.
- Rank Kriging: An Alternative Nonparametric Geostatistical Method (with M.M.A. Ananda and A.R. Sparks), presented at the Fifth International Conference on Chemometrics in Analytical Chemistry, Montreal, Canada, July 1992.
- A Bayesian Slippage Test for Outlying Sub-samples (with Anita Singh), poster presentation at the Fifth International Conference on Chemometrics in Analytical Chemistry, Montreal, Canada, July 1992.
- Bayesian Confidence Interval for the Product of Three Normal Means (with M.M.A. Ananda and G.Flatman), presented at the Fifth International Conference on Chemometrics in Analytical Chemistry, Montreal, Canada, July 1992.

- Adaptive Bayesian Estimation of Parameters of the Gompertz and Weibul Survival Model (with M.M.A. Ananda and R. Dalpatadu), presented at the 1992 Actuarial Conference in Iowa City.
- Bayesian Estimation of the Tabular Survival Models from Complete Samples (with M.M.A. Ananda and R. Dalpatadu), presented at the 1992 Actuarial Conference in Iowa City.
- Singh, A. and Singh, A.K., Flatman, G.T. (1993). "Estimation of Background Levels of Contaminants." Presented at the Annual Meetings of the American Statistical Association, held in San Francisco, August, 1993.
- Singh, A. and Singh A.K. (1994) " A Method of Trend Detection in Spatial Data Analysis." Presented at the international conference on Environmetrics, Burlington, Canada, August 11-15, 1994.
- Singh, A.K. and Sally Stewart (1994) " On the Use of Log-Normal Transformation in Environmental Data Analysis." Presented at the international conference on Environmetrics, Burlington, Canada, August 11-15, 1994.
- Gewali, L. P. , Ntafos, S., Singh, A. K.; Computation of optimal Bayesian credible sets for the binomial and Poisson distributions, Thirteenth International Conference on Boundary Element Technology (BETECH 99), in Las Vegas, Nevada, June 1999.
- Boundary Element Technology 1999 Incorporating Computational Methods and Testing for Engineering Integrity, Editors: C. S. Chen, C. A. Brebbia, D. W. Pepper; pp. 397-406. WIT Press, Southampton. (refereed publication).
- Singh, G. S., Dalpatadu, R., Singh, A. K.; Radioactive contaminant transport in fractured porous media: an analytical solution; Thirteenth International Conference on Boundary Element Technology (BETECH 99), in Las Vegas, Nevada, June 1999.
- Farnham, I., Singh, A.K., Jihanneson, K. H.; Determination of the optimal mixture distribution; Thirteenth International Conference on Boundary Element Technology (BETECH 99), in Las Vegas, Nevada, June 1999.
- Farnham, I., Singh, A. K.; A Comparison of Interpretation of Geochemical Data by Traditional Diagrams and Multivariate Statistical Methods; the 1999 Joint Statistical Meetings in Baltimore, Maryland, August 8-12, 1999.
- On the Computation of the Upper Confidence Limits of the Mean of a Lognormal Distribution in Environmental Applications; the 1999 Joint Statistical Meetings in Baltimore, Maryland, August 8-12, 1999.
- Deciphering GW Flow Patterns in Oasis Valley, Nevada Using Trace Element Chemistry,

- Multivariate Statistical Techniques and GIS (with Irene Farnham, Kevin Johannesson, Klaus Stetzenbach); Poster Presentation at the Fall 1999 Meeting of the American Geophysical Union, held in December 1999, San Francisco, CA.
- Rare earth Elements of Secondary Calcite from Pahute Mesa, Nevada Test Site, USA (with Xiaoping Zhou, Irene Farnham, Kevin Johannesson, Tomothy Rose, Chris Benedict); Poster Presentation at the Fall 1999 Meeting of the American Geophysical Union, held in December 1999, San Francisco, CA.
- Farnham, Irene, Stetzenbach, K. J., Singh, A. K., Johanneson, K. H.; Treatment of nondetects in multivariate analysis of groundwater chemistry data, Fourth International Conference on Environmetrics and Chemometrics, September 2000, Las Vegas, Nevada.
- Singh, A. K. and Ananda, M. M. A.; Rank Kriging for Characterization of Mercury Contamination at the East Fork Poplar Creek, Oak Ridge, Tennessee, Fourth International Conference on Environmetrics and Chemometrics, September 2000, Las Vegas, Nevada.
- Gewali, L. P., Dalpatadu, R. and Singh, A. K.; Computing Bayesian highest posterior density credible sets for the lognormal mean, Fourth International Conference on Environmetrics and Chemometrics, September 2000, Las Vegas, Nevada..
- Iaci, R. and Singh, A. K.; Gamma distribution as an alternative to the lognormal distribution in environmental applications, Fourth International Conference on Environmetrics and Chemometrics, September 2000, Las Vegas, Nevada.
- Schultz, B. and Singh, A. K.; Evaluation of the confidence removal goal approach for making remediation decisions at Metcoa Superfund Site, Fourth International Conference on Environmetrics and Chemometrics, September 2000, Las Vegas, Nevada.
- Farnham, I.M., Zhou, X., Stetzenbach, K. J., Singh, A. K., and Johannesson, K.H. 'Multivariate Statistical Analysis of Groundwater Trace Element Data To Evaluate Groundwater Flow in South-Central Nevada' Geological Society of America Summit 2000', Reno, Nevada.
- Farnham, I.M., Stetzenbach, K. J., Singh, A. K., Hodge, V., and Johannesson, K.H. 'Comparison of Factor Analysis Methods for Evaluating the Trace Element Chemistry of Groundwaters of Southern Nevada', Eighth International Conference on Chemometrics in Analytical Chemistry, Seattle, WA, September 25, 2002.
- Farnham, I.M., Stetzenbach, K. J., Singh, A. K., and Johannesson, K.H. 'Geochemical Evaluation of Groundwater from the Wells of the Nye County Early Warning Drilling Program', Devils Hole Workshop, Pahrump, Nevada, May 29 - 31, 2002.
- Ghosh, S., Hassan, S., Singh, A.K. 'Statistical Evaluation Of Bioremediation Of Petroleum-Contaminated Sites By Bacteria And Plants'. 2002 Denver Annual Meeting of Geological Society of America (October 27-30, 2002).

- Suresh Veluchamy, Andrew Cardno, Ashok K. Singh. Clustering as a Business Intelligence Tool (poster presentation). 1st IIMA International Conference on Advanced Data Analysis, Business Analytics and Intelligence, 6-7, June 2009, Ahmedabad, India.
- Andrew Cardno, Ashok K. Singh. TDWI (The Data Warehouse Institute).. Market Basket Analysis In a World Of GeoSpatial Interactions. June 15 – 17, 2009, Munich, Germany.
- Ross Iaci, Dennis Murphy, Andrew Cardno, Ashok K. Singh. Store Clustering of large Sparse Data Sets. M2009, 12-th Annual Data Mining Conference. Caesar's Palace, Las Vegas, Nevada, October 26-27, 2009.
- Ahlgren, Mikael; Dipendra Singh; Singh, Ashok K. Cross-State Substitution: Estimating the effect of the 2003 Illinois gaming tax restructuring on Indiana riverboat gaming volume in the Chicagoland region. 16th Annual Graduate Education and Graduate Student Research Conference in Hospitality and Tourism.
- Khago, Ahmed; Singh, Ashok K.; Gewali, Laxmi P. (January 2011). Bayesian Estimation of the Normal Mean from Censored Samples. Accepted for presentation and at the Conference Proceedings of the 8th International Conference on **Information Technology : New Generations**, Las Vegas, Nevada, April 2011.
- Fayad, Joseph; Singh, Aditi; Singh, Ashok; Chang, Kenneth; Fayad, Christina (October 2010). Stimulation of the Ileal Brake Hormones by an Orally Delivered Natural Product (Aphoeline I) to the Terminal Ileum of Healthy Volunteers. Presented at the 75th Annual Scientific Meeting of the American College of Gastroenterology, October 15 - 20, 2010 , San Antonio, Texas.