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**Cédric J. Sallaberry**  
**Senior Research Scientist (Mathematics, Probability, Statistics)**

### Qualifications

Dr. Sallaberry joined Engineering Mechanics Corporation of Columbus in July, 2015 after 15 years of experience in the area of uncertainty over complex systems.

Dr Sallaberry was a Member of the Technical Staff at Sandia National Laboratories (SNL) from 2003 to 2015 (starting as limited term and reaching the Principal Member status in 2012). He worked on the Yucca Mountain Project since his hiring in 2003. His collaboration with Jon Helton in the development of a new probabilistic framework separating aleatory and epistemic uncertainty for the Total System Performance Assessment (TSPA) led to the publication of several significant papers in refereed journals (one with more than 600 citations). Following the end of the Yucca Mountain project, his responsibilities cover the area mathematical and statistical expertise, uncertainty and sensitivity analysis. He has been involved in several projects including two NRC-sponsored: Extremely low probability of rupture (xLPR) where he was responsible for the whole framework development (including the uncertainty module) and State Of the Art Reactor Consequence Analysis – Uncertainty Analysis (SOARCA-UA) for which he was the lead on uncertainty propagation and statistical analysis (both for the study of Peach Bottom Power Plant and Surry Power plant). With Aubrey C. Eckert, they develop an improved mathematical approach to represent more accurately extreme sea states contour (open source code to be approved for release for the third quarter of 2015) as well as a dynamic model to optimize the factory process in developing wafers.

Prior to joining SNL, Mr. Sallaberry worked 2 years as a Post Doc for the French Radwaste Disposal Agency (ANDRA) and worked on the development and implementation of a probabilistic framework for the deterministic Performance Assessment used at that time.

### Education

- 2001            **Ph.D. - University of Bordeaux I, France, Dept. of Applied Mathematics.**  
Thesis subject: “Direct numerical simulation of incompressible flows in 2 and 3 dimensions”, supervised by Professor C.-H. BRUNEAU.
- 1996            **M.S. - University of Bordeaux I, France, Dept. of Applied Mathematics.**
- 1994            **B.S. - University of Bordeaux I, France, Dept. of Applied Mathematics.**

### Professional Experience

- July 2015 /            **Engineering Mechanics Corporation of Columbus (Emc<sup>2</sup>) – Senior Principal Engineer**  
Current
- xLPR (*Extremely Low Probability of Rupture*) in partnership with US-NRC (US Nuclear Regulatory Commission). *Development and implementation of probabilistic approach. Framework and modules development. Mathematical expertise (2015/current)*
- Oct. 2003 /            **Sandia National Laboratories, Albuquerque – Principal Member of the Technical Staff**  
July 2015

**Cédric J. Sallaberry (continued)**

- TSPA-LA (*Total System Performance Assessment- License Application*) for the Yucca Mountain Project. *data fitting, sensitivity and uncertainty analysis, Stability analysis, implementation of efficient probabilistic calculation with separation of aleatory and epistemic uncertainty.*(2003- 2009)
- xLPR (*Extremely Low Probability of Rupture*) in partnership with US-NRC (US Nuclear Regulatory Commission). *Development and implementation of probabilistic approach. Framework and modules development. Mathematical expertise* (2008/2015)
- SOARCA (*Stat-Of-the-Art Consequence Analyses project*) in partnership with US-NRC. *sensitivity and uncertainty analysis, Stability analysis,*(2010/2015)
- PLOAS (*Probability of Loss Assured Safety*) – *development of code estimating LOAS and CDF of link failure for a Weak Link/ Strong Link model.* (2011/2015)

**Feb. 2002 /  
July 2003**

**ANDRA (Agence Nationale pour la Gestion des Déchets Radioactifs) – Post-Doc.**

Sensitivity and uncertainty analysis for safety models.

- *International study of probabilistic approaches used for safety calculations of radioactive waste management.*
- *Survey of methods used in sensitivity and uncertainty analysis (probabilistic, FORM/SORM, response surface, fuzzy logic...).*
- *Implementation of several methods for sensitivity and uncertainty analysis in the ALLIANCES safety calculation platform (development of a statistical code in C)*

**Sept 1999 /  
June 2001**

**Research Assistant, University of Bordeaux I, France, Dept. of Applied Mathematics.**

Teaching of probability and statistics at college level. Teaching C language at graduate level.

**SELECTED PUBLICATIONS**

(Complete list at <http://scholar.google.com/citations?hl=en&user=SwYBBJEAAAAJ>)

Refereed Journals (selected publications)

“Uncertainty analysis for the net-section-collapse failure criterion of circumferentially cracked cylinders for multiple arbitrary-shaped circumferential cracks”, R. DINGREVILLE, A. ECKERT-GALLUP AND C.J. SALLABERRY – *International Journal of Pressure Vessels and Piping* **123** (2014) - pp. 30-45

“Adsorption and capillary condensation in porous media as a function of the chemical potential of water in carbon dioxide”, J.E. HEATH, C.R. BRYAN, E.N. MATTEO, T.A. DEWERS, Y. WANG AND C.J. SALLABERRY – *Water Resources Research* **50 - 3** (2014) , pp. 2718-2731.

“Probability of loss of assured safety in systems with multiple time-dependent failure modes: Representations with aleatory and epistemic uncertainty”, J.C. HELTON, M. PILCH AND C.J. SALLABERRY – *Reliability Engineering and System Safety* **124** (2014), pp. 171-200.

“Analysis of Computationally Demanding Models with Continuous and Categorical Inputs” C. B. STORLIE, .B.J. REICH, J.C. HELTON, L.P. SWILER AND C.J. SALLABERRY – *Reliability Engineering and System Safety* **113** (May 2013), pp. 30-41.

“Uncertainty and Sensitivity Analysis: From Regulatory Requirements to Conceptual Structure and Computation Implementation” J. HELTON & C. SALLABERRY *IFIP Advances in Information and Communication Technology* **377** (2012), pp. 60-76.

“ Use of Replicated Latin Hypercube Sampling to Estimate Sampling Variance in Uncertainty and Sensitivity Analysis Results for the Geologic Disposal of Radioactive Waste” C.W. HANSEN, J. HELTON & C. SALLABERRY *Reliability Engineering and System Safety* **107** (Sept 2012), pp. 139-148.

“Uncertainty and sensitivity analysis in performance assessment for the proposed high-level radioactive waste repository at Yucca Mountain, Nevada”, J.C. HELTON, C.W. HANSEN AND C.J. SALLABERRY – *Reliability Engineering and System Safety* **107** (2012) pp.44 -63.

“Quantification of margins and uncertainties: Example analyses from reactor safety and radioactive waste disposal involving the

**Cédric J. Sallaberry (continued)**

separation of aleatory and epistemic uncertainty”, J.C. HELTON, J. D. JOHNSON AND C.J. SALLABERRY – *Reliability Engineering and System Safety* **96** (2011) pp. 1014-1033.

“Representation of analysis results involving aleatory and epistemic uncertainty”, J.C. HELTON, J. D. JOHNSON, W. D. OBERKAMPF AND C.J. SALLABERRY – *International Journal of General Systems* **39** - 6 (2010) pp. 605-646.

“Implementation and Evaluation of Nonparametric Regression Procedures for Sensitivity Analysis of Computationally Demanding Models”. C. STORLIE, J.C. HELTON, L. SWILER, AND C.J. SALLABERRY – *Reliability Engineering and System Safety* **94** (2009) pp. 1735- 1763.

“Computational implementation of sampling-based approaches to the calculation of expected dose in performance assessments for the proposed high-level radioactive waste repository at Yucca Mountain, Nevada” J. C. HELTON AND C. J. SALLABERRY - *Reliability Engineering and System Safety* **94** (2009) pp. 699- 721.

“Conceptual basis for the definition and calculation of expected dose in performance assessments for the proposed high-level radioactive waste repository at Yucca Mountain, Nevada” J. C. HELTON AND C. J. SALLABERRY - *Reliability Engineering and System Safety* **94** (2009) pp. 677- 698.

“Extension of Latin Hypercube Samples with Correlated Variables”, C. J. SALLABERRY, J. C. HELTON, AND S.C. HORA - *Reliability Engineering and System Safety* **93** (2008) pp. 1047-1059.

“Survey of Sampling-Based Methods for Uncertainty and Sensitivity Analysis”, J. C. HELTON, J.D. JOHNSON, C. J. SALLABERRY, AND C.B. STORLIE – *Reliability Engineering and System Safety* **91** (2006) pp. 1175-1209

“Sensitivity Analysis in Conjunction with Evidence Theory - Representations of Epistemic Uncertainty”, J. C. HELTON, J.D. JOHNSON, W.L. OBERKAMPF, AND C.J. SALLABERRY – *Reliability Engineering and System Safety* **91** (2006) pp. 1414-1434

Conference proceedings (selected publications)

“Use of Replicated Latin Hypercube Sampling to Estimate Sampling Variance in Uncertainty and Sensitivity Analysis Results for the Geologic Disposal of Radioactive Waste” C.W. HANSEN, J. HELTON & C. SALLABERRY *Procedia – Social and Behavioral Sciences* **2**- 6 (Sept 2010) Sixth International Conference on Sensitivity Analysis of Model Output, pp. 7674-7675.

“Characterization, Propagation and Analysis of Aleatory and Epistemic Uncertainty in the 2008 Performance Assessment for the Proposed Repository for High-Level Radioactive Waste at Yucca Mountain, Nevada” C.W. HANSEN, J. HELTON & C. SALLABERRY *Scalable Uncertainty management: 4<sup>th</sup> International Conference* (Sept 2010) Toulouse, France. A. Deshpande and A. Hunter (Eds). LNAI 6379, pp. 177-190.

“Yucca Mountain 2008 Performance Assessment: Conceptual Structure and Computational Organization” J. HELTON, C. HANSEN & C. SALLABERRY *2008 IHLRW* (09/07-09/11 2008) Las Vegas, NV - USA

“Yucca Mountain 2008 Performance Assessment: Uncertainty and Sensitivity Analysis for Physical Processes” C. SALLABERRY, A. ARAGON, A. BIER, Y. CHEN, J. GROVES, C HANSEN, J. HELTON, S. MEHTA, S. MILLER, J. MIN & P. VO *2008 IHLRW* (09/07-09/11 2008) Las Vegas, NV - USA

“Aleatory and Epistemic Uncertainty in the Analysis of Complex Systems”, (1 hour tutorial) C. SALLABERRY & J. C. HELTON, IMAC XXV (02/19-02/22 2007) Orlando, FL - USA.

“Introduction to variance decomposition methods”, C. SALLABERRY & J. C. HELTON, IMAC XXIV (01/30-02/02 2006) St Louis, MO - USA.

“A Method for extending the size of a Latin Hypercube Sample”, C. SALLABERRY & J. C. HELTON, IMAC XXIII (01/31-02/03 2005) Orlando, FL - USA.

“An approach of Sensitivity and Uncertainty Analysis Methods Installation in a Safety Calculation”, G. PEPIN & C. SALLABERRY, *INTERNATIONAL Conference on Supercomputing in Nuclear Applications - SNA '03* (2003) Paris, France.

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“Sensitivity and Uncertainty Analysis Methods Installation in a Safety Calculation”, C. SALLABERRY, *Probabilistic Safety Assessment Conference - PSA'02* (2002), Detroit, USA.

**Book Chapter**

“Treatment of Uncertainty in Performance Assessments for the Geologic Disposal of Radioactive Waste” – J. C. HELTON & C. SALLABERRY in **Geological repositories for safe disposal of spent nuclear fuels and radioactive materials** – Ed. Ahn and Apted - *Woodhead Publishing* – Energy series n. 9 (2010)

**Other publications**

“Albuquerque – Richness of Statistics Profession Felt During Annual Meeting”, S. MICHALAK & C. SALLABERRY – *Amstat News* – n. 341 (Nov. 2005) – p. 49

**Professional Societies**

2004- current      American Statistical Association (<http://www.amstat.org> )

2005 - 2008      Society of Experimental Mechanics (<http://www.sem.org> )

2006              Founding Member of the Mu-Sigma-Rho society affiliated chapter in Albuquerque

**Professional Service**

Summer 2013      Invited teacher for a course on Spatial Variability and Sensitivity Analysis, sponsored by the IAEA (Vienna - Austria)

Spring 2010      Adjunct-Professor – University of New Mexico – Course on sensitivity and uncertainty analysis at graduate level.

2006/2007      Organizer and Chair for two sessions on Uncertainty Quantification at the IMAC XXIV and IMAC XXV conferences

2005 - 2009      Member of the Committee for the Mu-Sigma-Rho society affiliated chapter in Albuquerque

2004 - 2006      Vice-President and President of the Albuquerque Chapter of the American Statistical Association

Reviewer for *Stochastic Environmental Research & Risk Assessment* (SERRA)

Reviewer for *Reliability Engineering and System Safety* (RESS)

**Additional Information**

US citizen – DOE security L clearance granted

Fluent in French and English.