Robert S. Balch
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Education:

- ***1997 Ph.D. in Earth and Environmental Science with Dissertation in Geophysics*:**
  New Mexico Institute of Mining and Technology - *GPA 3.78/4.0*
  Dissertation: "Earthquake Swarm Studies in the Central Rio Grande Rift: Specific and General Results"
- ***1993 Master of Science in Geophysics*:**
  New Mexico Institute of Mining and Technology - *GPA 3.74/4.0*
  Independent Study: "New Constraints on the Socorro Magma Body Based on Improved Hypocenters"
- ***1989 Bachelor of Science*:**
  The Evergreen State College

Professional Experience:

- **Oil Conservation Commissioner:**
  State of New Mexico, Santa Fe – *6/2011 to present*
  Nominated by Energy Secretary John Bemis and appointed by Governor Martinez to the New Mexico Oil Conservation Commission. As one of three commissioners, hears cases, makes rulings and establishes regulations for oil and gas development in the state of New Mexico.

- ***Section Head/Scientist**:*
  Petroleum Recovery Research Center, New Mexico Tech - *07/04 to present*
  Directs research as head of the Reservoir Evaluation and Advanced Computational Technologies (REACT) Group. Administers research projects and supervises staff and student members of the research group. Conducts research in seismic applications to CO^2 sequestration monitoring, reservoir geomodeling, flow simulation, and application of soft computing technologies such as neural networks, expert systems, and data mining to upstream oil and gas problems. Submits research proposals to competitive funding programs.

- ***Interim Section Head/Research Scientist***:
  Petroleum Recovery Research Center, New Mexico Tech - *01/03 to 07/04*
  Directed research as interim head of the Reservoir Evaluation and Advanced Computational Technologies (REACT) Group. Completed work on existing funded project, supervised staff and student members of the research group, and acquired new competitive funding.

- ***Research Associate*:**
  Petroleum Recovery Research Center, New Mexico Tech - *10/97 01/03*
  Supervisor William W. Weiss. Conducted research as a member of the Reservoir Evaluation and Advanced Computational Technologies (REACT) Group. Work involved developing an Expert System to speed oil prospecting in the Delaware Basin using data at all scales—from well-logs to regional geophysical surveys. Other work included geostatistical evaluation of reservoir properties (EG porosity) using multiple regression and neural network applications with wire-line logs, 3D-seismic data and seismic attributes as inputs. Trained in, and used, LandMark software: SeisWorks, Zmap, PostStack/Pal packages.

- ***Post-Doctoral Researcher*:**
  New Mexico Bureau of Mines and Mineral Resources **-** *6/97 to 9/97*
  Supervisor, Bruce S. Hart. Used Sun Workstations and Landmark software to interpret horizons for a carbonate reservoir and to relate seismic attributes to porosity from wire-line logs, in the Smackover formation, Appleton Field Alabama.

- ***Graduate Research Assistant*:**
  New Mexico Tech - *9/92 to 5/97*
  Assistant to Dr. Allan R. Sanford. Used UNIX Workstations to perform research pertaining to rift processes and seismicity in the vicinity of Socorro, New Mexico; research funded by Los Alamos through IGGP Grants 349 and 349r.

- ***Seismicity of the WIPP Site*:**
  New Mexico Tech - *3/91 to 9/92*
  Supervisor, Dr. A. R. Sanford. Monitored seismic activity within 300 km of the WIPP site, Carlsbad, New Mexico. Reduction of data for quarterly reports to Westinghouse Corporation.

- ***Teaching Assistant*:**
  New Mexico Tech - *1991, 1992 and 1996*
  Instructed students in basic geophysical techniques including seismic refraction and reflection, gravity, and magnetic methods.

Synergistic Activities:

In My role as Section Head of the Reservoir Evaluation and Advanced Computational Technologies Group of the Petroleum Recovery Research Center, a research division of New Mexico Tech, I have taken advantage of rich interdisciplinary opportunities for professional, community, and academic involvement. I am actively involved in student education and training and hold, or have held positions as Adjunct Professor in the Departments of Computer Science and Petroleum Engineering. I have served as research advisor on the committees of 20 matriculated students (19 M.S and one PH.D) from three departments: Earth and Environmental Science, Computer Science, and Petroleum Engineering. Presently I serve as research advisor for six graduate students. I maintain an active involvement in the local chapters of SPE for which I

have served as an officer during the last 5 years. I am actively involved in community outreach and have given talks to local groups and public school classes on historic seismic activity in New Mexico, and to decision makers on issues facing the oil and gas industry. Since 1994 I have served as a judge for the New Mexico State Science Fair serving in the Junior and Senior Earth and Space Sciences categories. In 2007 I served as a judge in the INTEL international Science Fair.

Honors and Offices Held:

- ***Officer Roswell Section of the Society of Petroleum Engineers –*** *2004-present*
- ***Chapter President Sigma XI:***
  New Mexico Tech - *2001-02 and 2002-03*
- ***Seismic Engineer***:
  Mine Emergency Operations Team (New Mexico) of the Mine Safety and Health Administration, US Department of Labor - *1995-1997*
- ***Judge, New Mexico State Science Fair*:**
  Junior and/or Senior Earth and Space Sciences - *1994 – present*
- ***National Dean's List***:
  Academic Year - *1994-95*
- ***AMOCO Fellowship***:
  Academic Year - *1990-91*.
- ***Graduate Student Association officer***:
  New Mexico Tech - *1990-91, 91-92, 92-93, 93-94, 94-95, 95-96 and 96-97*
  Served as Graduate Council representative. Oversaw development of a new constitution and separation of graduate student funds from undergraduate Student Association. Served as first Executive Chair while constitution was developed.
- ***Secretary/Treasurer New Mexico Tech Geophysical Society***:
  Academic Year - *1992-93*

Professional Affiliations:

Society of Exploration Geophysics
Society of Petroleum Engineers
International Institute of Informatics and Systemics
Roswell Geological Society

Adjunct Positions:

Adjunct Professor of Petroleum Engineering, 2003-Present
Adjunct Professor of Computer Science, 2003-2007.

Major Projects:

- ***Southwest Regional Partnership for CO2 Sequestration:***
  The SWP was developed as a part of the U.S. Department of Energy's effort to respond to global climate change. The SWP has been challenged to evaluate available technologies that capture and store CO2 in the southwest region. The SWP includes portions of: Arizona, Colorado, Kansas, Nevada, New Mexico, Oklahoma, Texas, Utah and Wyoming. The SWP's Phase III Project is focused on a commercial scale demonstration of CO2 injection at the Gordon Creek field site in Central Utah. The project has $67 million in DOE funds and Phase III which began in August 2011 will last for ten years. Principal Investigator Robert Lee. **Responsibilities include: Design and implementation of seismic Monitoring, Verification, and Accounting program** including acquisition of 3D, 2D, VSP, and passive borehole seismic data with a budget of ~$10 million.

- ***Field Testing and Diagnostics of Radial-Jet Well Stimulation for Enhanced Oil Recovery from Marginal Reserves:***
  The objective of the research is to field demonstrate a newly developed radial jet technology for production enhancement from low-permeability reserves. Diagnostic techniques including distributed pressure sensors and electrical resistivity tomography for monitoring lateral direction and placement will also be developed and field tested. It is expected that successful completion of this project will answer the following questions: (1) How to control and diagnosis the placement and direction of laterals during a radial jet enhancement? (2) Is lateral jet enhancement cost-effective for enhancing productions of marginal reserves? (2) What are the preferred reservoir conditions and lateral patterns for deployment of radial jet technology from an existing wellbore? **Principal Investigator since June 2011**, two year, $1.4 million project funded by RPSEA March 2011.

- ***Reasonable Foreseeable Development (RFD) Scenario for the BLM New Mexico Pecos District:***
  Develop play analyses and projected development potential for 28 producing formations in the BLM's Pecos district, encompassing the New Mexico portion of the Permian basin. This work will be used to guide the BLM in best use of surface and mineral rights in a major oil and gas producing region of the United States. **Co-Principal Investigator.** 18 month, $400,000 contract awarded January 2010 by Bureau of Land Management.

- ***Reducing Impacts of New Pit Rules on Small Producers:***
  The objective of this project is to minimize the impact of new "pit rules" on New Mexico's small producers. The added cost of compliance and increased difficulty of permitting could price these producers, who as a whole produce the majority of New Mexico's marginal and mature fields, out of future drilling and production - thus reducing future reserves. New compliance will be required for a number of surface and subsurface features such as depth to groundwater, distance to surface water and variety cultural and environmental features. In partnership with

industry and the regulatory agency, this project is making available a wide selection of data needed for compliance, in acceptable automated formats. **Project Manager / Principal Investigator**. Two-year, $730,000 contract Funded August 2008.

- ***Cost-Effective Treatment of Produced Water Using Co-Produced Energy Sources for Small Producers****:*

  In this project, a low-temperature distillation process co-sited with the wellhead was designed for meeting the requirements of energy efficiency and tolerance to variable water chemistry. Through the proposed process, water will evaporate at an elevated temperature (i.e., 80°C) in a flowing air stream, followed by cooling and capillary condensation resulting in the collection of highly purified clean water. The average treatment cost of produced water purification with this method is estimated to be $0.79/bbl (compared to the current cost in NM of $~2.50/bbl), through implementing the following tactics: (1) solar energy and co-produced energy sources will drive the desalination process, thereby reducing electricity consumption; (2) a specific design will be implemented to maximize internal heat transfer and latent heat recovery; and (3) the process will be fitted to deploy at the wellhead; drastic decline in the need for water storage and transportation is expected as a result of the implementation of this new design concept. **Principal Investigator since June 2011,** $1.25 million, (July, 2008 – January, 2012): Research Partnership to Secure Energy for America (RPSEA).

- ***A Customizable Fuzzy Expert System for Regional and Local Play Analysis*****:**
  The objective of this project is to create a user-definable and customizable fuzzy expert system tool to dramatically speed local and regional play analysis and to reduce subsequent drilling risk. This general tool will not require significant knowledge of computer programming, and will guide users through the process of building a successful expert system to evaluate plays from field to basin scale using public and/or private data and their own or public data and knowledge. To demonstrate the effectiveness of the tool, a secondary objective of analyzing the Pennsylvanian play of southeast New Mexico will be performed. Public data will be organized for analyzing this outstanding, bypassed-pay play, which will provide an example of the usage of the system while simultaneously providing a significant opportunity for identifying new reserves. **Project Manager / Principal Investigator**. Three-year, $1.2 million contract awarded at end of 2004 by U.S. Department of Energy, commenced work January 2005.

- ***Petrophysical Analysis and Geographic Information System for San Juan Basin Tight Gas Reservoirs*****:**
  The primary goal of this project was to increase the availability and ease of access to critical data on the Mesaverde and Dakota tight gas reservoirs of the San Juan Basin. Secondary goals included tuning well log interpretations through integration of core, water chemistry and production analysis data to help identify bypassed pay zones; increased knowledge of permeability ratios and how they

affect well drainage and thus infill drilling plans; improved time-depth correlations through regional mapping of sonic logs; and improved understanding of the variability of formation waters within the basin through spatial analysis of water chemistry data. **Co-Principal Investigator.** $760,000 2 year contract awarded by U.S. Department of Energy October 2005. Project in final reporting December 2007.

- ***Risk Reduction With a Fuzzy Expert Exploration Tool*:**
  Prior to drilling expensive oil wells, companies evaluate drilling risk and economic potential for oil production. Smaller oil companies often lack the human resources to sort through the incomplete and sparse data involved in such evaluations. The Fuzzy Expert Exploration (FEE) Tool, a fuzzy expert system developed to emulate human explorationists, was successfully tested on two geologic formations, the Lower Brushy Canyon Sands of the Delaware basin, New Mexico, and the Siluro-Devonian carbonates of southeast New Mexico. The Tool uses unique fuzzy inference methods, and runs over the internet using a Java capable browser. **Principal Investigator - final three years**. $2.9 million contract awarded end of 1998 by U.S. Department of Energy, commenced work March 1999.

Research Advisor – Current Students

1. **Achanta**, S.: M.S. Petroleum Engineering
2. **Albaga**, R.: M.S. Petroleum Engineering
3. **Balmshkan**, T.: M.S. Petroleum Engineering
4. **Liu,** Y.: Engineering Management
5. **Luo,** A.: Engineering Management
6. **Moreno**, J.: Ph.D. Petroleum Engineering

Research Advisor for Matriculated Students:

1. **Bammidi**, V.:" Unconventional Oil & Gas Resource Evaluation of the Woodford Shale in New Mexico," M.S. Thesis Petroleum Engineering, New Mexico Institute of Mining and Technology, **August, 2011**.
2. **Chaves**, G.:" Simulation of CO2 Sequestration in Deep Saline Aquifers: Gordon Creek Utah," M.S. Thesis Petroleum Engineering, New Mexico Institute of Mining and Technology, **May, 2011.**
3. **Sedillo**, C.: "Applied Reservoir Simulation of Horse Canyon Field: Paradox Basin, Utah," M.S. Thesis Petroleum Engineering, New Mexico Institute of Mining and Technology, **January, 2011**.
4. **Ravada**, M.:"Floodplain Delineation, an Integrated ArcGIS, HEC-RAS Approach," M.S. Thesis Civil and Environmental Engineering, New Mexico Institute of Mining and Technology, **September, 2010**.
5. **Aung,** P. W.:"Analysis on EOR/CO2 Sequestration in SACROC Unit, Texas using a Compositional Simulator," M.S. Thesis Petroleum Engineering, New Mexico Institute of Mining and Technology, **August, 2009**.

6. **Sachidanand**, S.: ”Spatial analysis and Geographic Information Systems Presentation of Reservoir Properties for the Dakota Formation, San Juan Basin, New Mexico,” M.S. Independent Study Computer Science, New Mexico Institute of Mining and Technology, **December, 2007**.
7. **Iduri**, A. K.: ”Analysis of Well Completion Data to Predict First Year Gas Production for the Dakota formation, San Juan basin, New Mexico,” M.S. Independent Study Computer Science, New Mexico Institute of Mining and Technology, **August, 2007**.
8. **Al-Tailji**, W.: “Analysis of Well Completion Data with Data Mining Techniques for the Dakota formation, San Juan basin, New Mexico,” M.S. Thesis Petroleum Engineering, New Mexico Institute of Mining and Technology, **December, 2006**.
9. **Goteti**, R.: “Automated Fuzzy Set Construction for Knowledge Bases using Efficient Algorithms in Knowledge Engineering,” M.S. Independent Study Computer Science, New Mexico Institute of Mining and Technology, **December, 2006.**
10. **Obaid**, K.:”Data Management Subsystem and the Online Expert Survey for the Customizable Fuzzy System” M.S. Independent Study Computer Science,” New Mexico Institute of Mining and Technology, **December, 2006.**
11. **Xu,** W.: “Interface Definition and Generator subsystem for a Customizable Fuzzy System,” M.S. Independent Study Computer Science, New Mexico Institute of Mining and Technology, **June, 2005**.
12. **Huang**, X.: “Graphical Representations of the Results of the FEE Tool and Fuzzy Variable Definition System,” M.S. Independent Study Computer Science, New Mexico Institute of Mining and Technology, **December 2004**.
13. **Schrader**, S. M.: “Development, Testing and Application of an Expert System for Petroleum Exploration,” Ph.D. Dissertation Petroleum Engineering, New Mexico Institute of Mining and Technology, **May 2004**.
14. **Choudhari**, G.: “Contributions towards the Development and Design of the Delaware Basin FEE Tool and the Devonian Carbonate FEE Tool,” M.S. Independent Study Computer Science, New Mexico Institute of Mining and Technology, **May 2004**.
15. **Koganti**, M.K.: “Contributions to the Fuzzy Expert Exploration Tool,” M.S. Independent Study Computer Science, New Mexico Institute of Mining and Technology, **November 2003**.
16. **Subramaniam**, V.: “Evaluation of Well Completion Opportunities in the Lower Brushy Canyon Using Neural Networks,” M.S. Thesis, Petroleum Engineering, New Mexico Institute of Mining and Technology, **December 2002**.
17. **Gottumkkala**, V.: “A New Method of Calibrating Wireline Logs with Carbonate Core Measurements to Recognize Pay Zones,” M.S. Thesis Petroleum Engineering, New Mexico Institute of Mining and Technology, **August 2002**.
18. **Du**, Y.: “Optimization of Artificial Neural Network Design through Synthetic Datasets Analysis,” M.S. Thesis Computer Science, New Mexico Institute of Mining and Technology, **May 2002**.
19. **Liang**, B.: “Cherry Canyon Well Logging Interpretation by Artificial Neural Network,” M.S. Thesis Petroleum Engineering, New Mexico Institute of Mining and Technology, **May 2002**.

20. **Hart**, D. M.: "Evaluation of a Multi Layer Perceptron Neural Network for the Time-to-Depth Conversion of the Nash Draw "L" Seismic Horizon using Seismic Attributes," M.S. Thesis Geophysics, New Mexico Institute of Mining and Technology, **May 2001**.

Papers and Publications:

1. **Balch**, R., and Parker, A., (2011): "A Generalized Oil and Gas Regulatory Data Mapping Portal," paper and presentation at World Multi-Conference on Cybernetics and Informatics. Orlando, FL, July 19-23.
2. Bammidi, V., **Balch**, R., and Engler. T. (2011): "Ranking the resource potential of the Woodford Shale in New Mexico," paper **SPE 144576** presented at the SPE Western North American Regional Meeting held in Anchorage, Alaska, May 7–11.
3. **Balch**, R., and Parker, A. (2011): "A Generalized Oil and Gas Regulatory Data Mapping Portal," paper and presentation at the Southwest Petroleum Short Course, Lubbock, Texas, April 20–21.
4. Bammidi, V., Cather, M., Engler. T. **and Balch**, R. (2011): "Conventional and Unconventional Resource Evaluation in the Southeast New Mexico: Old and New Plays," paper and presentation at the Southwest Petroleum Short Course, Lubbock, Texas, April 20–21.
5. Bammidi, V., **Balch**, R., and Engler. T. (2011): "Ranking the Resource Potential of the Woodford shale in New Mexico," paper and presentation at the Southwest Petroleum Short Course, Lubbock, Texas, April 20–21.
6. **Balch**, R., Cather, M., and Bammidia, V. (2009): "Oil and Gas Potential Analysis of the Secretary of theInterior's Potash Area, Southeastern New Mexico**."** PRRC Report 09-07.
7. **Balch**, R. (2008). Optimizing Completion Techniques with Data Mining. Short Course and Paper presented at the Southwest Petroleum Short Course Conference, Lubbock, Texas, April 23–24.
8. **Balch**, R.S., S.M. Schrader, and T. Ruan (2007): "Collection, storage, and application of human knowledge in expert system development", ***Expert Systems,*** Vol. 24, No. 5 (November 2007) p. 346-355.
9. Schrader, S.M., R.S **Balch**, and D. Bunnell (2007): "Where will the Next Generation of Petroleum Engineers Come From? Disturbing Observations from a Texas Oil town", paper **SPE 110686**, 2007 Annual Technical Conference and Exhibition, Anaheim, CA, November 11-14.
10. **Balch**, R. S., T. Ruan, and S. Schrader (2005): "Fuzzy Expert Systems in Oil Exploration", SIAM Conference on Computational Science and Engineering, Orlando, Florida, Feb. 12-15, 2005.
11. Schrader, S.M., **Balch, R.S**., Ruan, T. (2005): "Using Neural Networks to Estimate Monthly Production: A Case Study for the Devonian Carbonates, Southeast New Mexico," paper **SPE 94089**, 2005 SPE Production and Operations Symposium, Oklahoma City, April 17-19.
12. Schrader, S.M., R.S. **Balch**, and T. Ruan: "Knowledge Management, Collection and Storage in Expert System Development," *Upstream CIO* (September 2005) 22-24.

13. **Balch**, R. S., T. Ruan, W. W. Weiss, and S.M. Schrader (2003): "Simulated Expert Interpretation of Regional Data to Predict Drilling Risk," paper **SPE 84067,** 2003 SPE Annual Technical Conference and Exhibit, Denver, October 4-8.
14. **Balch**, R. S., T. Ruan, and S. Schrader (2003): "Automating Basic Exploration Processes Using an Expert System: Applications to the Delaware Basin," In: *The Permian Basin: Back to Basics*: West Texas Geological Society, Publication **No. 03-112**, p. 285-294.
15. Schrader, S. M., R.S. **Balch**, and Ruan, T (2003): "Preserving and Applying Expert Knowledge: A Case Study for the Brushy Canyon Formation of the Delaware Basin", In: *The Permian Basin: Back to Basics*: West Texas Geological Society, Publication **No. 03-112**, p. 295-304.
16. **Balch**, R.S., W.W. Weiss, and T. Ruan (2002): "Simulated Expert Interpretation of Data to Predict Drilling Risk on a Regional Scale, Case Study—Brushy Canyon Formation, Delaware Basin, New Mexico," In: *The Permian Basin: Preserving our Past – Securing Our Future*: West Texas Geological Society, Publication **No. 02-111**.
17. **Balch**, R. S., D. M. Hart, W. W. Weiss, and R. F. Broadhead (2002): "Regional Data Analysis to Better Predict Drilling Success: Brushy Canyon Formation, Delaware Basin, New Mexico," Paper **SPE 75145**, Society of Petroleum Engineers, 2002 IOR Conference, Tulsa, Oklahoma, 13–17 April.
18. Weiss, W. W., R.S. **Balch**, and B. A. Stubbs (2002): "How Artificial Intelligence Methods Can Forecast Oil Production," paper **SPE 75143** presented at the 2002 SPE Symposium on Improved Oil Recovery, Tulsa, April 13–17.

19. Weiss, W. W., V. Gottumukkala, and R. S. **Balch** (2002): "A New Method of Calibrating Wireline Logs with Carbonate Core Measurements to Recognize Pay Zones," paper **SPE 77330** presented at the 2002 SPE Annual Technical Conference and Exhibit, San Antonio, Sep. 29.
20. Weiss, W. W., B.A. Stubbs, and R.S. **Balch** (2001): "Estimating Bulk Volume Oil in Thin-Bedded Turbidites," paper **SPE 70041** presented at the 2001 SPE Permian Basin Oil & Gas Recovery Conference, Midland, May 14-17.
21. **Balch**, R.S., W.W. Weiss, S. Wo, and D. M. Welch (2000): "Predicting Core Porosity Using Wireline Logs at Dagger Draw Field, Southeast New Mexico," paper **SPE 59554** presented at the 2000 SPE Permian Basin Oil & Gas Recovery Conference, Midland, March 21–23.
22. **Balch**, R.S., W.W. Weiss, S. Wo, and D. M. Hart (2000): "Regional Data Analysis to Determine Production Trends Using a Fuzzy Expert Exploration Tool," in: *The Permian Basin: Proving Ground for Tomorrow's Technology*, West Texas Geological Society, Publication **No. 00-109** p. 195-196.
23. Hart, D.M., **Balch**, R.S., Tobin, H.J., and Weiss, W.W. (2000): "Time-to-Depth Conversion of Nash Draw "L" Seismic Horizon Using Seismic Attributes and Neural Networks," paper **SPE 59555** presented at the 2000 SPE Permian Basin Oil and Gas Recovery Conference, Midland, March 21–23.
24. Hart, B.S., and R. S. **Balch** (2000): "Approaches to Defining Reservoir Properties from 3-D Seismic Attributes with Limited Well Control: An Example from the

Jurassic Smackover Formation, Alabama," ***Geophysics***, Vol 65, no. 2 **(**March-April 2000) p. 368-376.

25. Weiss, W.W., S. Wo, R. S. **Balch**, L. Scott, and R. P. Kendall (2000): "Assessing the Potential Redevelopment of a 1960's Vintage Oil Field," paper **SPE 59297** presented at the 2000 SPE/DOE Improved Oil Recovery Symposium, Tulsa, April 3–5.
26. Wo, S., W.W. Weiss, R. S. **Balch**, L. Scott, and R. P. Kendall, (2000): "New Technique to Determine Porosity and Deep Resistivity from Old Gamma Ray and Neutron Count Logs," paper **SPE 59553** presented at the 2000 SPE Permian Basin Oil and Gas Recovery Conference, Midland, March 21–23.
27. Wo, S., W. W. Weiss, R. S. **Balch**, L. Scott, J. Roe, and R. Kendall (2000): "Producing GOR Used to Predict Permeability Distribution in a Tight Heterogeneous Reservoir," paper **SPE 56505** presented at the 1999 SPE Annual Technical Conference, Houston, October 3–6.
28. **Balch**, R.S., B.A Stubbs, W. W. Weiss, and S. Wo (1999): "Using Artificial Intelligence to Correlate Multiple Seismic Attributes to Reservoir Properties," paper **SPE 56733** presented at the 1999 SPE Annual Technical Conference and Exhibit, Houston, October 3–6.
29. Weiss, W.W., S. Wo, and R. S. **Balch** (1999): "Integrating Core Porosity and Sw Measurements with Log Values," paper **SPE 55642** presented at the 1999 SPE Rocky Mountain Regional Meeting, Gillette, May 15–18.
30. **Balch**, R. S., M. Hand, D. Carr, and C. Reuter (1998): "Natural Fractures in Gas Reservoirs: Detection and Prediction," White Paper for Gas Research Institute, Contract No. 5097-210-3966.
31. **Balch**, R. S., W. W. Weiss, and S. Wo (1998): "Correlating Seismic Attributes to Reservoir Properties Using Multi-Variate Non-Linear Regression," in: *The Search Continues into the 21st Century*, West Texas Geological Society, Publication **No. 98-105**, p. 199-203.
32. **Balch,** R. S., A. R. Sanford, H. E. Hartse, and K. Lin (1997): "A New Map of the Geographic Extent of the Socorro Midcrustal Magma Body," *Bull. Seismol. Soc. Am.* **87**, 174-182.

Invited Presentations:

33. **Balch,** R. (2011): "An Oil and Gas Regulatory Data Mapping Portal," Presented at RPSEA small producer forum, Bakersfield, CA, October 10.
34. **Balch,** R. (2011): "Energy Outlook: New Mexico, USA, and Global Perspectives," Association of Commerce and Industry Annual Retreat, Farmington, NM, June 28.
35. **Balch,** R. (2010): "Mandatory Greenhouse Gas Reporting – Impacts on Oil and Gas Producers," Global Energy and Environmental Issues Conference, Santa Fe, NM, December 9-12.
36. **Balch**, R. (2010): "The New Mexico Pit Rule Mapping Portal," presented at the Research Partnership to Secure Energy for America Small Producer Program Showcase, University of Texas-Permian Basin, Midland, Feb. 4.
37. **Balch**, R. (2010): "The Petroleum Recovery Research Center of New Mexico

Tech," presented at Yangtze University, Jinzhao China, June 3.

38. **Balch**, R. (2008): "Reducing Impacts of New Pit Rules on Small Producers," Presented at the Roswell SPE Meeting, Artesia, NM, Sept 3.
39. **Balch**, R. S. (2003): "Risk Reduction with a Fuzzy Expert Exploration Tool," West Texas Geological Society Lunch Talk, Midland, September 9, 2003.

Presentations, Abstracts and Reports:

40. **Balch**, R., Cather, M, and Bammidi, V. (2011): "Oil and Gas Potential in the Secretaries Potash Enclave," presented at the Southwest AAPG Convention, Ruidoso, NM June 7.
41. **Balch, R.** 2010): "The New Mexico Pit Rule Mapping Portal,", presented at the American Association of Petroleum Geologists - Rocky Mountain Section Meeting, Durango, June 13-16.
42. **Balch**, R. (2009): "Helping Producers with the Pit Rule," Presented at the Independent Petroleum Association of New Mexico Annual Meeting Farmington, NM, August 7–8.
43. **Balch**, R., and Iduri, A. (2008): "Data Mining Well Completion Data for the Dakota Formation, San Juan Basin, New Mexico," American Association of Petroleum Geologists - Rocky Mountain Section Meeting, July 9-11.
44. **Balch**, R. and Broadhead, R. (2007): "Customizable Fuzzy Expert for Regional and Local Play Analysis," second annual technical progress report, U.S. DOE Contract No. DE-FC26-04NT15512.
45. Ruan, T., R.S. **Balch**, and D. M. Hart (2005): "A Web-Based Fuzzy Ranking System and Application," 9th World Multiconference on Systemics, Cybernetics and Informatics, Orlando, Florida, July 10-13, 2005.
46. **Balch**, R. S. (2005): Final Project Review "Risk Reduction with a Fuzzy Expert Exploration Tool", Tulsa, Oklahoma, DOE/NETL Office, April 20, 2005
47. **Balch**, R. S., T. Ruan, and S. Schrader (2005): "Fuzzy Expert Systems in Oil Exploration", SIAM Conference on Computational Science and Engineering, Orlando, Florida, Feb. 12-15, 2005.
48. **Balch**, R. S. and S. Schrader (2004): Devonian FEE Tool Training Session, Roswell, New Mexico, ENMU-R, Dec. 1, 2004.
49. Ruan, T., R. S. **Balch**, and S. Schrader (2004): "A Web-Based Database Management System," IASTED International Conference on Communications, Internet and Information Technology, St. Thomas, U.S. Virgin Islands, November 22-24, 2004.
50. Ruan, T., R. S. **Balch**, and S. M. Schrader (2004): "The Fuzzy Expert Exploration Tool," Sixth IASTED International Conference on Intelligent Systems and Control, Honolulu, August 23-25, 2004.

51. **Balch**, R. S., T. Ruan, and S. M. Schrader (2004): "Drilling Risk Reduction with a Fuzzy Expert Exploration Tool" presented at the 2004 American Association of Petroleum Geologists, Southwest Section Annual Meeting, El Paso, Texas, March 8-9.

52. Project Review, “Risk Reduction with a Fuzzy Expert Exploration Tool,” Albuquerque, New Mexico, Wyndham Hotel, Oct. 29-30, 2003
53. **Balch**, R. S. (2003): Delaware FEE Tool Training Session, Roswell, New Mexico, ENMU-R Aug. 27, 2003
54. **Balch**, R.S., W. W. Weiss, and T. Ruan (2003): “Simulated Expert Interpretation of Data to Predict Drilling Risk on a Regional Scale, Case Study—Brushy Canyon Formation, Delaware Basin, New Mexico” *Poster*, SW Section AAPG Annual Meeting, Fort Worth, Texas, March 2-6, 2003.
55. **Balch**, R. S., R. Lee, and A. Reisinger (2003): Project status report “Risk Reduction with a Fuzzy Expert Exploration Tool,” Tulsa, Oklahoma, DOE/NETL Office, January, 2003
56. Project Review, “Risk Reduction with a Fuzzy Expert Exploration Tool,” Roswell, New Mexico, ENMU-R, Sept. 17, 2002
57. **Balch**, R. S., D.M. Hart, W.W. Weiss, and R. F. Broadhead (2002): “Using Artificial Intelligence to Predict Drilling Success Using Regional Data, Brushy Canyon Formation, Delaware Basin, New Mexico” *Transactions*, Southwest Section A.A.P.G Convention, Ruidoso, New Mexico, June 6-8, 2002.
58. **Balch**, R.S., D. M. Hart, W. W. Weiss, and R. F. Broadhead (2002): “Using Artificial Intelligence to Predict Drilling Success Using Regional Data, Brushy Canyon Formation, Delaware Basin, New Mexico,” *Transactions,* Southwest Section A.A.P.G Convention, Ruidoso, June 6–8, 2002.
59. Project Review, “Risk Reduction with a Fuzzy Expert Exploration Tool,” Midland, Texas, Petroleum Club, Oct. 24, 2001.
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