NM EPSCOR & UNM CREST PRESENT

NEW MEXICO ACADEMY OF SCIENCE

RESEARCH Symposium

NOVEMBER 14, 2015

HYATT REGENCY ALBUQUERQUE

SYMPOSIUM PROGRAM

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UNM | *Center for Water and the Environment*

The UNM CREST Center is focused on increasing the participation of underrepresented minorities (URM) in science, technology, engineering and math (STEM) professions while conducting cutting-edge research into technological and engineering-based solutions to problems with water and the environment. An integral part of the CREST Center is to increase the participation of underrepresented minorities in STEM professions. An integrated, coordinated set of activities to recruit, retain, and graduate students from underrepresented groups will be implemented, as reflected in the diagram below. The Center will leverage existing programs at UNM, including advising, tutoring, scholarships, and multicultural programs. The Center will also developing new capabilities, including the WAVE, a high-school introduction to engineering course, a summer field class, and a water competition. Visit http://cwe.unm.edu/research/nsf-crest.html for more information.

NMAS
New Mexico Academy of Science

Founded in 1902, the New Mexico Academy of Science has been in continuous existence since 1915. The Academy is a member of the National Association of Academies of Science (NAAS) and an affiliate of the American Association for the Advancement of Science (AAAS). The New Mexico Academy of Science works with teachers,state agencies, and the legislature to establish appropriate standards for the teaching of the sciences. The Academy can also act as a resource center, providing scientific advice and expertise to these groups and others. The Academy Goals are to foster scientific research and scientific cooperation, increase public awareness of the role of science in human progress and human welfare, and promote science education in New Mexico. Membership is open to any person or organization engaged in or interested in scientific research, scientific education, or the goals and activities of the Academy. Visit www.nmas.org to learn more.

New Mexico EPSCoR

The New Mexico Experimental Program to Stimulate Competitive Research (NM EPSCoR) is funded by the National Science Foundation (NSF) to build the state's capacity to conduct scientific research. Faculty and students from New Mexico universities and colleges are working to realize the state's potential for sustainable energy development, and cultivating a well-qualified Science, Technology, Engineering and Mathematics (STEM) workforce while supporting a culture of innovation and entrepreneurship. The infrastructure and activities of Energize New Mexico are designed to support shared-use equipment, engage new research and community college faculty, and support the STEM pipeline by training teachers, undergraduate and graduate students, and post-doctoral fellows. Research findings will be communicated broadly through new partnerships with New Mexico's museum network, a citizen-centric web portal, and vibrant, experiential programs targeting K-12 students. Visit www.nmepscor.org to learn more about NM EPSCoR, and visit www.nsf.gov/epscor to learn more about NSF EPSCoR and other state EPSCoR programs.

SYMPOSIUM AGENDA

10:30-11:00 AM	Registration check-in
11:00 AM-12:30 PM	Luncheon with Keynote: Dr. Vipin Gupta *Power on Demand (PoD) Research Challenge*
12:40-2:20 PM	Concurrent Sessions (20 minute oral presentations) *Session A: Fuel Cells, Biofuel, and Algae* *Session B: Geothermal & Geological Processes* *Session C: Biology & Ecology*
2:30-3:30 PM	Poster Session
3:40-5:20 PM	Concurrent Sessions (20 minute oral presentations) *Session D: Influences on Water Quality* *Session E: Education, Health, and the Economy* *Session F: Chemistry & Solar Power*
5:30-6:30 PM	Reception and Awards *Heavy appetizers and no-host bar*
6:30 PM	Adjourn

KEYNOTE: POWER ON DEMAND

The goal of the Power on Demand Research Challenge is to develop new technologies that dramatically improve the size, weight, and power of electrical energy systems at all scales, while maintaining or improving their efficiency, performance, resiliency, robustness, safety, and controllability. By 2025 we will demonstrate a 10X decrease in the size, weight and added power consumption (SWaP) of electrical energy systems for both mobile and stationary applications. Sandia National Laboratories will contribute to a revolution in electrical power technologies by undertaking focused technology campaigns in a small number of key focus areas. Power on Demand's focus areas were selected by a careful consideration of input collected broadly from a diversity of Sandia stakeholders. Accordingly, we have selected the following primary thrust areas: Battery-based electrical energy storage; Power electronics: wide bandgap materials, devices, and power systems; and Energy generation: microsystem-enabled photovoltaics.

Vipin Gupta is a systems engineer at Sandia National Laboratories. His work has spanned system design, technology innovation, solar technical assistance, human factors engineering, and team development. Early on, Vipin worked on satellite imaging for monitoring nuclear test sites and the exploration of anti-neutrino detectors for nuclear non-proliferation. Through a Science Fellowship at Stanford University, he developed a workable concept of secure economic zones that straddle two countries; and joined a solar water distillation startup. More recently, he led a project to provide solar technical assistance throughout the United States and innovating with his inventive Sandia teammates in microscale photovoltaics. Vipin earned his PhD in applied physics from Imperial College London and an M.S. in remote sensing from University College London as a US Marshall Scholar.

OUTSTANDING NEW MEXICO SCIENCE TEACHERS

TURTLE HASTE, DESERT RIDGE MIDDLE SCHOOL

Ms. Haste has been teaching science for 25 years and currently teaches 7th and 8th grade science at Desert Ridge Middle School in Albuquerque. She has a B.S. in Physical Geography from the University of Central Missouri and an Masters in Science Education from Oregon State University. She is a National Board for Professional Teaching Standards Certified Teacher in Early Adolescent Science. She holds a NASA Endeavor Fellow STEM Certificate from Columbia University Teacher College. In 2007 she was a NOAA Teacher at Sea, and in 2014-2015 she was named a Teachers For Global Classrooms Fellow. Very recently she was honored as one of the New Mexico Women of STEM for her contributions in motivating young women to pursue education and careers in STEM fields, as well as the NOAA Excellence in Science Education Award for 2015.

Haste is known for her connections with researchers around the world, showing her students how the topics they study are being explored by scientists. Her students have exchanged e-mails, packages, and the occasional video hook-up with researchers in Antarctica. A "sun shadows" project was the first middle school science project ever accepted for presentation at the American Geophysical Union Annual Conference. Her nominator for the NMAS Award said the following about her: "She uses her curiosity, knowledge, and awe of the physical world around her to instill excitement in her students. When she introduces basic and very important scientific concepts, she does so in fun and entertaining ways."

ANNA SUGGS, ZIA MIDDLE SCHOOL

Anna Suggs has been a sixth grade teacher for 21 years. For the last 15 years, she has been teaching sixth grade science at Zia Middle School in Las Cruces NM. She has a B.S. in agricultural animal science and an M.A. in curriculum and instruction, both from New Mexico State University. During her tenure at Zia Middle School, she has been instrumental in implementing and participating in multiple after school science and technology programs. Her students at Zia also have worked in coordination with Spaceport America to build and launch small rockets carrying payloads.

Her desire to inspire young scientists has led to her (and her students') participation in the NASA Remote Sensing Earth Science Teacher Program in cooperation with Goddard Space F;ight Center. Ms. Suggs and her students have been doing research at White Sands National Monument for 5 years. The research was to determine the impact of human activity on the dune field and the students worked with satellite data and a small UAV flown by the local model airplane club. This research has involved hundreds of students as well as teachers, university personnel, members of the model airplane club, and parents. In 2015, she received the Presidential Award for Excellence in Mathematics and Science Teaching, one of only 102 mathematics and science teachers from all 50 states, the District of Columbia, Puerto Rico and the Department of Defense Education Activity to receive the award.

Ms. Suggs said the award is affirmation and inspiration to her. "The award affirms that the years of hard work, of constantly refining the art of teaching science, have been recognized," she said. "The inspiration is that, now that I have the award, I must continue work to empower my students and colleagues with a love of science and learning."

CONCURRENT SESSIONS 12:40–2:20 PM

SESSION A: FUEL CELLS, BIOFUEL, AND ALGAE

Moderator: Anton Sumali, SNL — Room: Enchantment A & B

Jennifer Thompson, University of New Mexico
The effect of salinity on the growth rate of Nannochloropsis salina *algae cells*

Sarah Kinter, University of New Mexico
Temperature effects on biodiesel production an mixed algal community composition grown in a synthetic high saline brine media

Kodanda Phani Raj Dandamudi, New Mexico State University
Co-liquefaction of mixed culture micro-algal strains under subcritical water conditions

Sadia Kabir, University of New Mexico
Palladium nanoparticles supported on 3D-Graphene electrocatalysts for fuel cells

Juchao Yan, Eastern New Mexico University
Algal Turf Scrubber® in treating dairy manure effluents from Eastern New Mexico

SESSION B: GEOLOGICAL & GEOTHERMAL PROCESSES

Moderator: Jayne Aubelle, NMMNHS — Room: Enchantment C & D

Jeff Pepin, New Mexico Tech
The groundwater flow patterns associated with the formation of the Truth or Consequences, NM geothermal resource

Marisa Repasch, University of New Mexico
Longevity of northern New Mexico geothermal systems inferred from 40Ar/39Ar dating of Taos Plateau basalts and fault slip history

Wesley Clary, University of New Mexico
Glacial and tectonic interactions: Case study in southeast Alaska

Thomas Luckie, University of New Mexico
Using ground-penetrating radar to image the near surface deformation of Denali fault zone, central Alaska

Chris McGibbon, University of New Mexico
Carbonic springs as distal manifestations of the Jemez geothermal system, San Ysidro, NM, highlighting the importance of fault pathways and hydrochemical mixing

SESSION C: BIOLOGY & ECOLOGY

Moderator: David Peters, SNL — Room: Enchantment E & F

Adrienne Hubbard, University of New Mexico
Study of cave specimen from Cave 12 in New Mexico

Calvin Vialpando, New Mexico Highlands University
The effects exerted on garter snake population structure in northern New Mexico by bullfrogs

Theresa Garcia, University of New Mexico
Xanthophyll analysis of high desert trees

Virginia Thompson, University of New Mexico
Submerged aquatic macrophytes–Ecosystem engineers in New Mexico mountain streams

Diana Perales, Central New Mexico Community College
Evaluation of Arabidopsis thaliana*: photosynthesis*

CONCURRENT SESSIONS 3:40–5:20 PM

SESSION D: INFLUENCES ON WATER QUALITY

Moderator: Kurt Anderson, NMAS — Room: Enchantment A & B

Samantha Saville, New Mexico Tech
Uranium capture on modified inorganic-organic graphite hybrid material to develop a specific uranium binding filtrate for mining reclamation and private water uses

Natalie Correa, University of new Mexico
Elemental concentrations in wildfire ash

Sumant Avasarala, university of New Mexico
Effect of intermittent flow on metals mobilized from Native American abandoned uranium mine waste sites

Nabil Shaikh, University of New Mexico
Spectroscopic investigation of organic compounds and manganese oxides

Cherie DeVore, University of New Mexico
The fate of metals near abandoned uranium mine wastes

SESSION E: EDUCATION, HEALTH, AND THE ECONOMY

Moderator: Jason Jackiewicz, NMSU — Room: Enchantment C & D

Natalia Sanabria, University of New Mexico
The economic impacts of wildfires on the built and natural critical civil infrastructure

JT Goodart, Grants High School
The Cancer Breathalyzer: Chemical strips that detect chemicals in lung cancer "breathprint"

Nader Vadiee, Southwest Indian Polytechnic Institute
Information technology experiences using simulated tele-science exploration of Mars

Fadi Jamaleddin ahmad, University of New Mexico
Evaluation of a paraprofessional-delivered diabetes education at a South Valley clinic

Kip Carrico, New Mexico Tech
Emerging air quality issues in New Mexico and the West

SESSION F: CHEMISTRY & SOLAR POWER

Moderator: Donivan Porterfield, LANL — Room: Enchantment E & F

Chao Dong, New Mexico State University
Effect of Lewis acid on oxygen atom transfer in molybdenum model complexes

Rajana Dangi, University of New Mexico
Distortion induced acceleration of intersystem crossing

Alan Thomas, University of New Mexico
Interchain charge transfer states mediate triplet formation in polymer nanofibers

Keda Hu, University of New Mexico
Functional polymers derived from trans-enediyne monomers

Jianzhong Yang, University of New Mexico
Molecular breakwater-like tetrapods for organic solar cells

2015 POSTER SESSION PARTICIPANTS

(01) The effect of salinity on the growth rate of *Nannochloropsis salina* algae cells
JENNIFER THOMPSON / UNIVERSITY OF NEW MEXICO / UNDERGRADUATE STUDENT

(02) Trace element mobility in water and sediments in a hyporheic zone adjacent to an abandoned uranium mine
CLAUDIA ROLDAN / UNIVERSITY OF NEW MEXICO / UNDERGRADUATE STUDENT

(03) Elemental concentration in wildfire ash
NATALIE CORREA / UNIVERSITY OF NEW MEXICO / UNDERGRADUATE STUDENT

(04) When light breaks the long night: stratospheric ozone depletion in the Antarctic
MELISSA MONTOYA / CENTRAL NEW MEXICO COMMUNITY COLLEGE / UNDERGRADUATE STUDENT

(05) Evaluation of a paraprofessional delivered diabetes education project with a South Valley clinic
FADI JAMALEDDIN AHMAD / UNIVERSITY OF NEW MEXICO / UNDERGRADUATE STUDENT

(06) Cultivation of locally adapted algal community on an Algal Turf Scrubber for treatment of dairy wastewater
DAVID ARELLANO / EASTERN NEW MEXICO UNIVERSITY / FACULTY

(07) The effects of light and rainwater on the growth and metabolism of *N. salina* and *G. sulphuraria*
SHALEEN EICKHOFF / EASTERN NEW MEXICO UNIVERSITY / UNDERGRADUATE STUDENT

(08) Assessing uranium contamination in stream sediment on the Navajo Nation
BRIANNE WILLIS / EASTERN NEW MEXICO UNIVERSITY / UNDERGRADUATE STUDENT

(09) Determining chemical composition of wildfire ash particulates
CHRIS HIRANI / UNIVERSITY OF NEW MEXICO / UNDERGRADUATE STUDENT

(10) Hydrothermal liquefaction of various algae in batch and continuous flow reactors
FENG CHENG / NEW MEXICO STATE UNIVERSITY / GRADUATE STUDENT

(11) Evaluating seasonal streamflow forecasts for southwestern snow fed rivers
SHALEENE CHAVARRIA / UNIVERSITY OF NEW MEXICO / GRADUATE STUDENT

(12) Using ground-penetrating radar to image the near surface deformation of a fault zone, Denali Fault, Central Alaska
THOMAS LUCKIE / UNIVERSITY OF NEW MEXICO / GRADUATE STUDENT

(13) Glacial and tectonic interactions: Case study Southeast Alaska
WESLEY CLARY / UNIVERSITY OF NEW MEXICO / GRADUATE STUDENT

(14) Ultra-fast time-resolved fluorescence spectroscopic characterization of rare earth metal-based nanomaterials
RUWINI RAJAPAKSHA / NEW MEXICO TECH / GRADUATE STUDENT

(15) Evaluation of *Arabidopsis thaliana*: Photosynthesis
DIANA PERALES / CENTRAL NEW MEXICO COMMUNITY COLLEGE / UNDERGRADUATE STUDENT

(16) Risk analysis of recycling containment and treatment of produced water from oil and gas production: A conceptual framework
KATIE ZEMLICK / UNIVERSITY OF NEW MEXICO / GRADUATE STUDENT

(17) Modeling bathymetry and topography maps using an Augmented Reality Sandbox
RYAN POTTENGER / MESALANDS COMMUNITY COLLEGE / GRADUATE STUDENT

(18) Experimental Design: Polycultures of 25 common North American freshwater microalgae species
LAURA JACK / NEW MEXICO STATE UNIVERSITY / GRADUATE STUDENT

(19) Using geochemical tracers to understand geothermal flow pathways in northern New Mexico
VALERIE BLOMGREN / UNIVERSITY OF NEW MEXICO / UNDERGRADUATE STUDENT

(20) Effects of silica sol-gel encapsulation on *C. reinhardtii* metabolism
JOHN ROESGEN / UNIVERSITY OF NEW MEXICO / GRADUATE STUDENT

(21) Building a network from two networks: Sucesses and challenges
AYESHA BURDETT / NEW MEXICO MUSEUM OF NATURAL HISTORY & SCIENCE / CURATOR

(22) Palladium nanoparticles supported on 3D-Graphene electrocatalysts for fuel cells
SADIA KABIR / UNIVERSITY OF NEW MEXICO / GRADUATE STUDENT

(23) The effect of biofilm carrier length on nitrification in moving bed biofilm reactors: An examination of mixing intensity, shock loadings, and pH changes on biofilm activity
KODY GARCIA / UNIVERSITY OF NEW MEXICO / GRADUATE STUDENT

(24) Mantle CO_2 degassing and fluid migration along fault networks in the northwestern Albuquerque Basin and Valles Caldera
JARED SMITH / UNIVERSITY OF NEW MEXICO / GRADUATE STUDENT

(25) Assessing the geomorphological effects of animal exclosures on a high elevation stream in the Valles Caldera National Preserve
RYAN KELLY / UNIVERSITY OF NEW MEXICO / GRADUATE STUDENT

(26) Algal system for BOD and nutrient removal from urban wastewater: Pilot scale study
SHANKA HENKANATTE-GEDARA / NEW MEXICO STATE UNIVERSITY / GRADUATE STUDENT

(27) Reactor design and operation variables to improve mixed algae biomass production and stability
DEREK WICHHART / UNIVERSITY OF NEW MEXICO / GRADUATE STUDENT

(28) Evaluation of the accumulation of trace metals on iron-manganese couatings on *in-situ* stream pebbles and emplaced substrates
MARGARET TURPIN / UNIVERSITY OF NEW MEXICO / GRADUATE STUDENT

(29) What's inside an invasive frog? Sexual comparison of bullfrog diet of the Mora River
STEVEN SALINAS / NEW MEXICO HIGHLANDS UNIVERSITY / GRADUATE STUDENT

(30) The ecological role of cougars within a multispecies predator-prey system
ARTHUR ANAYA / NEW MEXICO HIGHLANDS UNIVERSITY / GRADUATE STUDENT

(31) Economic impact of natural gas production in the San Juan Basin
JANAK JOSHI / UNIVERSITY OF NEW MEXICO / GRADUATE STUDENT

(32) Xanthophyll analysis of high desert trees
THERESA GARCIA / UNIVERSITY OF NEW MEXICO / UNDERGRADUATE STUDENT

(33) Distortion induced acceleration of intersystem crossing
RANJANA DANGI / UNIVERSITY OF NEW MEXICO / GRADUATE STUDENT

(34) Identification of cold-stress response genes in *Nannochloropsis salina* using RT-PCR
SABA GILL / NEW MEXICO STATE UNIVERSITY / GRADUATE STUDENT

(35) Characterization of physiological response in *Nannochloropsis salina* to cold stress
STEPHANIE WILLETTE / NEW MEXICO STATE UNIVERSITY / GRADUATE STUDENT

(36) Geochemistry of sinkholes in the Santa Rosa, New Mexico area
MARIAH KELLY / UNIVERSITY OF NEW MEXICO / UNDERGRADUATE STUDENT

(37) Stratigraphic relationships and physical properties of young sediment offshore southeastern Asia
RACHEL PRICE / UNIVERSITY OF NEW MEXICO / UNDERGRADUATE STUDENT

(38) Forgiveness aversion: the influence of perceived forgiveness risks on forgiveness motivation
ANGEL DE NIEVES ARELLANO / NEW MEXICO HIGHLANDS UNIVERSITY / GRADUATE STUDENT

(39) Membrane distillation in water treatment
XU WANG / NEW MEXICO TECH / GRADUATE STUDENT

(40) Short duration aquifer test within a fractured crystalline basement reservoir, Truth or Consequences, New Mexico
MICHELLE SHERMAN / SANTA FE COMMUNITY COLLEGE / UNDERGRADUATE STUDENT

(41) Methods for protecting the growth of *G. sulphuraria* as wastewater
ELAN GLENDENING / NMSU: ALAMOGORDO / UNDERGRADUATE STUDENT

(42) The effects of geothermal fluids on surface water quality in the Jemez River system in Northern New Mexico
VANESSA WARD / SANTA FE COMMUNITY COLLEGE / UNDERGRADUATE STUDENT

(43) Alkalic epithermal gold mineralization, southwestern Platoro caldera: An examination of a shallow extinct geothermal system
JEFFREY HRNCIR / UNIVERSITY OF NEW MEXICO / GRADUATE STUDENT

(44) Evaluation of zinc sulfide and copper oxide as catalysts for chemical carbon mitigation
HANQING PAN / NEW MEXICO TECH / GRADUATE STUDENT

(45) The economic impacts of wildfires on the built and natural critical civil infrastructure
NATALIE SANABRIA / UNIVERSITY OF NEW MEXICO / GRADUATE STUDENT

(46) Preferences on energy regulations, tradeoffs and how they vary across New Mexico
KARA WALTER / UNIVERSITY OF NEW MEXICO / GRADUATE STUDENT

(47) Using graphicalanalysis and geothermometry to compare water chemistry among various sites throughout Colorado and New Mexico
TANNER GRULKE / UNIVERSITY OF NEW MEXICO / UNDERGRADUATE STUDENT

(48) Use of chemical and isotopic identifiers to characterize a uranium contaminated groundwater plume in New Mexico
MITCHELL SCHATZ / UNIVERSITY OF NEW MEXICO / GRADUATE STUDENT

(49) Complexation and redox reactions affecting uranium recovery by in situ leaching
OMAR RUIZ / UNIVERSITY OF NEW MEXICO / GRADUATE STUDENT

(50) Beneficial use of produced water in Pressure Retarded Osmosis
STEVEN ALARID / NEW MEXICO TECH / UNDERGRADUATE STUDENT

(51) Water Purification: Insights on the catalytic activity of defect free- and rich-molybdenum disulfide (MoS_2) nanosheets for the photocatalytic removal of carcinogenic chromium(VI) ions
SWAGOTOM SARKER / NEW MEXICO STATE UNIVERSITY / GRADUATE STUDENT

(52) Solution processed strontium titanate as a cathodic buffer layer for polymer solar cells
HONGMEI LUO / NEW MEXICO STATE UNIVERSITY / FACULTY

(53) Lipid extraction from algal biomass for biofuel production
TANAKA PFUPAJENA / EASTERN NEW MEXICO UNIVERSITY / GRADUATE STUDENT

(54) Screening test of four low temperatures on a natural mixed algal population preserved with methanol or dimethyl sulfoxide for viability and identification of reconstituted species analysis
SARAH KINTNER / UNIVERSITY OF NEW MEXICO / GRADUATE STUDENT

(55) Growing microalgae in dairy manure effluents for sustainable biofuel production
BIN BAI / EASTERN NEW MEXICO UNIVERSITY / GRADUATE STUDENT

(56) Comparison of evapotranspiration estimates produced by the simplified surface energy balance model and a portable chamber measurement device
IAN HEWITT / NEW MEXICO STATE UNIVERSITY / GRADUATE STUDENT

(57) Imaging geothermal reservoir features with magnetotellurics
MATTHEW FOLSOM / NEW MEXICO TECH / GRADUATE STUDENT

(58) Algal indicators of acidic inputs and intermittent flow in streams in the Valles Caldera National Preserve
APRIL FOX / UNIVERSITY OF NEW MEXICO / GRADUATE STUDENT

(59) Hydrochemistry of Sulphur Springs and Alamo Creek, Valles Calders: Effect of geothermal systems on surface water quality
GRAHAM THOMAS / UNIVERSITY OF NEW MEXICO / UNDERGRADUATE STUDENT

YOU CAN DOWNLOAD ALL POSTER SESSION ABSTRACTS AT HTTP://BIT.LY/NMAS2015POSTERS

CONCURRENT SESSIONS ABSTRACTS

Session A: Fuel Cells, Biofuel, and Algae

Moderator: Anton Sumali, SNL

Room: Enchantment A & B

The effect of salinity on the growth rate of *Nannochloropsis salina* algae cells

Jennifer Thompson, University of New Mexico

Water and land are the largest resources needed in the cultivation of algae for biofuel production. It is necessary to find ways to cultivate algae without impinging on fresh water resources, especially in arid regions. Certain species of algae including ***Nannochloropsis salina*** can be cultivated in hypersaline environments. The purpose of this experiment was to test the effect that salinity has on the growth rate of ***N. salina*** algal cells with the intention of exploring alternative water sources that can be used for the cultivation of algae. ***N. salina*** is a marine algae therefore it was hypothesized that algal cells that were exposed to hypersaline growth media would experience a faster growth rate versus algal cells grown in hyposaline growth media. For this experiment, three ***N. salina*** algal cultures were grown in bioreactors in growth media of a specific salinity. The ***N. salina*** algal cultures were grown in bioreactors that contained growth media of either 50‰ (hypo), 100‰ (control), or 150‰ (hyper) the salinity of seawater. Chlorophyll content, optical density, photosynthetic electron transfer rate, and pH were measured on the cultures during the experiment. Quantitative analysis of experimental data strengthened the hypothesis that algal cells grown in hypersaline media experienced an exponentially higher growth rate. The increased growth rate of ***N. salina*** in hypersaline environments imply that algae may be cultivated for the production of biofuel in non-traditional water sources such as water from oil and gas production, thus limiting competition for fresh water resources in arid regions.

Keywords: N. salina, algae, biofuel, alternative, water

Temperature effects on biodiesel production and mixed algal community composition grown in a synthetic high saline brine media

Sarah Kinter, University of New Mexico

Little investigation has been undertaken to determine how wild xenic algal communities adapt to culturing in a laboratory batch reactor and ultimately their ability to produce biodiesel. This study develops a fundamental understanding of how a xenic natural mixed algal community grown under continuous high light in a synthetic brine media at room and high temperature affects algal growth, lipid production, and mixed community composition to improve biodiesel production. A mixed algal population was harvested from the San Acacia Brine Pond, New Mexico. Two sets of three flasks filled with algal culture in synthesized media were sampled every other day for 14 days. Samples analyzed were chlorophyll a, nitrate consumption, fatty acid methyl ester lipids, and pyrosequencing. Light intensity (both studies), light cycle, room and high temperatures were 1400 µmol Photons/s^2 m^2, 14.5/9.5 hrs Diel, 25/20 °C Day/Night, and 40/35 °C Day/Night correspondingly. The room temperature total identified fatty acid methyl ester lipid curve exceeded that of the high temperature. The top 99‰ room temperature algal population species contained three Chlorophyta species, one Heterokontophyta species, and two Cyanobacteria two species. The top 99‰ high temperature algal population species contained only three Cyanobacteria species. The room temperature algal population produced the most total identified fatty acid methyl ester compared to the high temperature. At the room temperature, the algal population composition contained more species due to the temperature growth range of the Chlorophyta and Heterokontophyta, while the high temperature culture contained only high temperature adapted Cyanobacteria.

Keywords: Mixed algal community, biodiesel, pyrosequencing

Co-liquefaction of mixed culture micro algal strains under subcritical water conditions

Kodanda Phani Raj Dandamudi, New Mexico State University

Poly culture micro algal growth attained recent attention to address efficient waste water treatment systems and production of fuel precursors. To estimate the conversion efficiency of such produced biomass, algae samples were processed using hydrothermal liquefaction (HTL) as it is one of the productive thermochemical conversion processes capable of converting wet feedstock into renewable bio-oils. In this study, thermo-acidophilic microalgae Cyanidioschyzon merolae (CM) and Galdieria sulphuraria (GS) were co-liquefied under hydrothermal conditions in a stainless-steel batch reactor. The temperatures and CM/GS mass ratios were varied from 150 to 300°C and 0 to 100% respectively. All the experiments were performed at 20% solid loading and at a reaction time of 30 min. The maximum bio-crude yield was obtained at 300°C and at a mass ratio of 4:1 (CM/GS). A positive synergetic effect is observed for the bio-crude yield, which is dependent on temperature and mass ratio. The bio crude oils were analyzed using Time of Flight Gas Chromatography Mass Spectrometry (TOF-GC/MS) and Fourier Transform Ion Cyclotron Resonance Mass Spectrometer (FT-ICR MS). FT-ICR MS analysis of the bio crude oils indicate that both the co-liquefied and pure individual algal oils are compositionally similar but their relative intensities changed with process parameters. Ultimate and proximate analysis was also performed for the algae biomass, biocrude oil and biochar.

Keywords: Hydrothermal co-liquefaction; synergetic effect, FT-ICR MS

Palladium nanoparticles supported on 3D-Graphene electrocatalysts for fuel cells

Sadia Kabir, University of New Mexico

Fuel cells are one of the most promising sustainable energy technologies for energy conversion. However, current fuel cells rely on platinum electrocatalysts, which are expensive and lack long term stability. Alternatively, Palladium (Pd) has been attracting growing interest due to their thermal stability and excellent activity. However, Pd nanoparticles used as catalysts for fuel cells are usually supported on amorphous carbon supports which are prone to corrosion. If has therefore become imperative to develop relatively cheaper catalytic materials with improved performance and durability. In view of that, our present work adopts the Sacrificial Support Method developed at UNM for the synthesis of porous crystalline 3D-Graphene nanosheets. The nanosheets were then utilized as a support material for Pd nanoparticles deposited using the original Pd-precursor based Soft Alcohol Reduction Method. The obtained materials were comprehensively characterized by X-ray diffraction (XRD), transmission electron microscopy (TEM), and scanning transmission electron microscopy (SEM). Our results show that the 3D-Graphene support materials had a high surface area (~300 m2/g) and porosity. The Pd nanoparticles synthesized using ethanol as a reducing agent in the SARM fabrication method had an average size of 4.3 nm as well as the highest electrochemical activity and durability when supported on 3D-Graphene, with a peak current density of over 1550 A/gPd for ethanol electrooxidation. The results from this research will not only lead to the development of highly efficient catalytic materials for fuel cells, but also lead to the advancement and successful commercialization of sustainable emerging energy technologies.

Keywords: energy, electrocatalysts, fuel cell, graphene

Algal Turf Scrubber® in treating dairy manure effluents from Eastern New Mexico

Jennifer Thompson, University of New Mexico

Algal Turf Scrubber® (ATS) uses solar/algal technology to harness attached, primarily filamentous algae for biofuel feedstock, and to simultaneously clean wastewater and impaired water as well. ATS thus offers an economically and environmentally sustainable technology in scaling up algal cultivation in outdoor settings. Funded by the NSF-EPSCoR and Eastern New Mexico University, in 2013 we constructed our outdoor ATS in Portales, New Mexico. Our system has a carbon recovery unit, which contains ca. 10,000 gallons of scrubber effluents consisting of dairy manure effluents

and fresh well water. The effluents are continuously recycled to a floway at precisely controlled flow rates. The floway is 100-feet long and 1-foot wide, and has a surface area of 9.29 m2 and a slope of 0.5%. For more than one and a half years now, our system has been in stable operation. In this presentation, I will focus on the baseline performance of our system, including real-time monitoring of the cultivation broth (pH, temperature, oxidation reaction potential, and conductivity), nutrient analysis, and biomass harvesting, purification and drying. We will also present our preliminary data on biomass productivities, algae strain identification and semi-quantification, ash content, lipid extraction, analysis of carbohydrate and fatty acid methyl ester by Gas Chromatography-Mass Spectrometry.

Keywords: algae, wastewater, algal biofuel, Algal Turf Scrubber®

Session B: Geological and Geothermal Processes

Moderator: Jayne Aubelle, NMMNHS

Room: Enchantment C & D

The groundwater flow patterns associated with the formation of the Truth or Consequences, New Mexico geothermal resource

Jeff Pepin, New Mexico Tech

We have investigated two of the most plausible regional groundwater circulation scenarios responsible for the formation of the Truth or Consequences, New Mexico hot springs (~ 41 °C) in the southern Rio Grande rift. The first scenario is that the geothermal anomaly is the result of lateral forced convection associated with a gently-dipping carbonate aquifer. The second scenario is that high permeability of crystalline basement rocks permits circulation of groundwater down to depths of 8 km prior to discharging in Truth or Consequences. We constructed a 2D hydrothermal model of the region using FEMOC to test these hypotheses. Model parameters were constrained by calibrating to measured temperatures, specific discharge rates and groundwater residence times. Hot springs geochemistry is consistent with water/rock interaction in a silicate geothermal reservoir, rather than a carbonate system. Peclet-number analysis of temperature profiles suggests specific discharge rates beneath Truth or Consequences range from 2 to 4 m/year, while geothermometry indicates maximum reservoir temperatures are around 167 °C. We were able to reasonably reproduce observed measurements using the permeable-basement scenario while assigning a uniform effective basement permeability of 10-12 m2. Implementing the exponential decay crustal permeability relationships that are often applied in regional groundwater models was unable to reproduce our field measurements. The carbonate-aquifer scenario failed to match observations. Our findings imply that this geothermal system formed as a result of deep groundwater circulation within permeable crystalline basement rocks. Ongoing work is focused on refining our model using aquifer test results and magnetotellurics.

Keywords: Geothermal, permeability, hydrothermal modeling, deep groundwater circulation

Longevity of northern New Mexico geothermal systems inferred from $^{40}Ar/^{39}Ar$ dating of Taos Plateau basalts and fault slip history

Marisa Repasch, University of New Mexico

$^{40}Ar/^{39}Ar$ geochronology of the Taos Plateau Volcanic Field (TPVF) records the spatial and temporal distribution of magmatic activity in northern New Mexico over the last ~5 Ma. Probability density plots and histograms of the data show two major pulses of volcanism: 5.0-4.5 Ma and 3.6-2.9 Ma. Spatial distribution of age data show migration of the heat source beneath northern New Mexico from the earliest TPVF eruptive activity at Cerro Montosa at 5.88 ± 0.18 Ma, the oldest basalts in the vicinity of Cerro Chiflo near the Rio Grande Gorge, the youngest basalts in the northwest TPVF near San Antonio Mountain, and final eruptive events that took place in the northeast TPVF north of

Ute Mountain. Dacites record sub-volcanic intrusions, which were also emplaced during two major pulses: 4.8 Ma and 3.3-2.8 Ma. Stratigraphic relationships among dacites and basalts of the TPVF are well exposed within the Rio Grande Gorge where the Rio Grande has incised into the landscape up to 250 m. The Embudo fault was most active between 3 Ma and 2 Ma, while the La Bajada fault experienced the most displacement within the last 2.5 Ma. Modern hot springs are located along the Gorge fault, where deeply circulated groundwater emerges along intersecting faults near river level. The occurrence of faults along the Rio Grande, and the presence of mantle-derived magmatic volatiles in the hot springs suggest modern hot springs may have been active over the last three million years.

Keywords: geochronology, geothermal systems, faults

Glacial and tectonic interactions: Case study Southeast Alaska

Wesley Clary, University of New Mexico

In the last decades research has shown that climate activity can be an important component of large scale tectonics. Glacial erosion and deposition, forced by climate patterns, affect mass balance in large-scale tectonically active regions as well as offshore depositional basins. One ideal natural laboratory to study these climate-tectonic interactions is offshore glacial-marine deposits in SE Alaska where an offshore accretionary wedge records glacial and marine sedimentation as well as faulting. This location is ideal because the offshore depositional basin is near the onshore sediment source which facilitates a short time between erosion and deposition as well as a relatively closed system from source to basin. Thanks to previous research efforts there is extensive data including sediment core, well log measurements, bathymetry, and offshore seismic reflection surveys available to aide in the interpretation of climate-linked glacial activity and fault activity. Detailed stratigraphic and structural interpretation of seismic reflection lines collected off the coast of SE Alaska allow for sequence interpretation of fault activity, glacial deposition, and climate change. Interpretation of sedimentation patterns with special focus on extent and style of glacial sedimentation and fault activity link these processes in space and time. Applied spatial-statistics provides a quantitative link between glacial activity and faulting by testing for shape similarity and proximity of related geologic features.

Keywords: tectonics, glaciers, seismology, stratigraphy

Using ground-penetrating radar to image the near surface deformation of a fault zone, Denali Fault, central Alaska

Thomas Luckie, University of New Mexico

The use of ground-penetrating radar (GPR) can provide detailed, centimeter-scale resolution images of the subsurface to a depth of tens of meters. Alaska is one of the most seismically active areas in the United States, but few faults have undergone detailed studies of Quaternary stratigraphy and near-surface structure. In the summer of 2015, a pilot study collected and analyzed 2-D GPR data across the Denali Fault in central Alaska to help constrain near-surface deformation. A basic data processing flow and a 1-D, single-layer velocity model was applied in order to conduct preliminary interpretations. We observed clear reflections to a depth of ~7 m below the ground surface. Data collected at co-located paleoseismic trenching mimic the near-surface reflections and help ground-truth the GPR data. The combined data sets provide insight into the north-south limits of the deformation zone of the fault at this site, along with fault zone morphology at a shallow (<7 m) depth. However, farther from the trenching exposures, the GPR data were less clear as to whether it displayed any reflection patterns indicative of fault zones, which may be due to adverse environmental conditions for GPR implementation. The poor imaging leads to more speculative interpretations, making correlation between the trenching exposures and the GPR data difficult. This pilot study demonstrates the potential use of GPR in the characterization of faults and the advantages and disadvantages of using GPR in conjunction with trenching and outcrop interpretation.

Keywords: Ground-penetrating radar, active faults, Denali Fault, Alaska

Carbonic springs as distal manifestations of the Jemez geothermal system, San Ysidro, New Mexico, highlighting the importance of fault pathways & hydrochemical mixing

Chris McGibbon, University of New Mexico

Deeply sourced waters can contribute significant quantities of salinity to groundwater, degrading water quality, with faults acting as conduits for subsurface fluid flow. Understanding source, movement, and chemistry of groundwater is becoming more urgent with changing climate and weather patterns. Sampling was carried out on three groups of carbonic warm/hot springs in New Mexico: Tierra Amarilla, Peñasco springs (San Ysidro), and Soda Dam, Jemez and Indian hot springs. Multiple hydrochemical tracers were applied to quantitatively evaluate possible flow paths and mixing. Three hypotheses were tested for source and transport of waters to these springs: San Juan basin origin, meteoric flow from the Nacimiento Mountains, and/or influence from the Valles Caldera geothermal system. Tracers defining mixing trends are: major ions, stable isotopes, conservative tracers, and helium isotope ratios. Lithium, boron, and bromine values all show the San Ysidro springs to have hydrochemical influence from the Valles Caldera geothermal system. Helium gas data show elevated 3He/4He values consistent with contributions from the Jemez volcanic system. At San Ysidro spring groups, plots of high Lithium/Boron versus chloride suggest geothermal waters acquire chloride from other sources, including salts from the Paleozoic and Mesozoic aquifers. We interpret these carbonic springs to be distal manifestations of fluid circulation along faults with mixtures of Jemez geothermal waters and waters sourced from either/both San Juan Basin aquifers and meteoric sources. Semi-confined fault conduits provide connectivity between spring systems and explain geochemical similarities and mixing trends between Valles Caldera, Soda Dam/Jemez Springs with the more distal San Ysidro springs.

Keywords: Geochemistry, faults, water, isotopes, spring, Jemez

Session C: Biology & Ecology

Moderator: David Peters, SNL

Room: Enchantment E & F

Study of cave specimen from Cave 12 in New Mexico

Adrienne Hubbard, University of New Mexico

Increased diversity of infectious bacteria complicates possible eradication of harmful diseases. Uncovering the mechanisms that enable microorganisms to live in harsh conditions may illuminate effective components for better medicines. Specifically, remote places, like the walls of lava tube caves, can expose relationships between bacterial structures and their survival resources. This study mapped locations of bacteria's possible energy sources along with locations of flowing, standing, and still water in Cave 12. Further, different areas inside and above the lave tube cave were swabbed for bacteria specimens. The microbes were cultivated at room temperature for two days, after which, the mother plates were transferred to a 4°C refrigerator for an additional 12 days. Then, we analyzed the internal cave and surface colonies' morphologies and created subcultures. At three weeks of growth, gram stain, catalase, and oxidase tests analyzed the microbial structures of the subcultures. The morphologies and oxidase test results varied depending on sample origin. Gram stain tests from different subcultures were mostly positive. The catalase test results were all positive. The test results revealed possible correlations between bacterial structures and the originating location of the colony. A thick cell wall is common in the Cave 12 habitat. The cytochrome c oxidase enzyme is not present in all colonies. A surprising result from the catalase test was most microbes have the ability to break down H_2O_2. Altogether, these results about the bacterial structures that thrive in harsh environments enable future research to investigate antibacterial applications.

Keywords: microbiology, microbial structures, antibacterial applications

The effects exerted on garter snake population structure in Northern New Mexico by bullfrogs

Calvin Vialpando, New Mexico Highlands University

Most studies looking into the effects bullfrogs have on native species have largely focused on the impacts they have on different amphibian species. However, little is known if semi-aquatic reptiles have similar effects. In Arizona and California bullfrogs are known to have a negative effect on the more aquatic Mexican garter snake and giant garter snake populations respectively. In this study, I looked to determine if bullfrogs have an effect on garter snake populations in northern New Mexico. The study took place at the Rio Mora National Wildlife Refuge (RMNWR) in northeastern New Mexico along the Mora River. We placed two boardline transects (n=95 per transect) in two treatment groups, a control (where bullfrogs are left unmanaged) and an experimental (where bullfrogs are managed). The boardline transects were checked from early May to mid-October. Western terrestrial garter snakes were the most abundant species encountered during the duration of the study with the control site having a higher density despite the high abundance of bullfrogs in that area. Plains garter snakes were only detected in the experimental site where bullfrogs are constantly being managed,. Despite being present at the RMNWR, black-neck garter snakes were absent along the two study sites. Bullfrogs do not appear to exert similar effects on the more terrestrial western terrestrial garter snake as they do on more aquatic species as seen in Arizona and California. Few plains garter snakes were detected to make an accurate assessment on how bullfrogs influence their populations.

Keywords: Garter snakes, bullfrogs, Mora River, RMNWR

Xanthophyll Analysis of High Desert Trees

Theresa Garcia, University of New Mexico

Xanthophylls are light sensitive plant pigments that help compensate for free radicals by dissipating excess absorbed light energy. Light is a necessity for plant survival, but too much light can generate oxygen reactive species that can damage or even kill a plant. Plants adjust their light harvesting complexes to optimize light utilization, but this process is slow relative to daily environmental variation and the onset of stress. Xanthophylls can convert to light dissipating forms within minutes, so they provide a lot of flexibility plants need. Very little research has been done to explore these compounds in native New Mexican species Juniperus monosperma, and Pinus edulis, which grow in high light, upper elevations, and regularly experience drought. We developed a rapid and improved separation and analysis of the xanthophylls, violaxanthin, antheraxanthin, and zeaxanthin, through ultra-high pressure supercritical fluid chromatography. We then used this method to compare xanthophyll composition of both species grown under heat, drought, and combined heat and drought conditions.

Keywords: Xanthophylls, chromatography, tree, stress conditions

Submerged aquatic macrophytes: Ecosystem engineers in New Mexico mountain streams

Virginia Thompson, University of New Mexico

Submerged aquatic macrophytes are ecosystem engineers that can significantly modify abiotic and biotic conditions in their environment. Normally studied in low elevation, low gradient, highly impacted systems, we studied a high elevation, low human impact mountain stream in the Jemez Mountains. Macrophyte species were identified, life history (phenology) observations were taken, instream biomass quantified, and macrophyte effects on water quality and response to disturbance were measured. The four species present were found to be *Elodea canadensis*, *Ranunculus aquitilis*, *Potamogeton richardsonii*, and *Stuckenia pectinata*. Total mean biomass from 2011-2013 peaked at over 1000 g/m2. Biomass measures were sensitive to disturbance events, and continuous measurements of dissolved oxygen at

the site followed similar patterns to macrophyte phenology. This study provides a foundation for understanding the presence and impacts of a specific plant class in a high elevation mountain stream habitat. Mountain headwater areas are key water sources worldwide for cities that depend on surface water for human consumption. As human demands on water resources increase in the face of climate change and growing populations, greater understanding of the impacts these plants have on headwater stream ecosystems enhances our knowledge of the role of these ecosystem engineers in low gradient montane headwater streams worldwide.

Keywords: Submerged aquatic macrophytes, disturbance, dissolved oxygen, aquatic ecosystems, high elevation

Evaluation of *Arabidopsis thaliana*: Photosynthesis

Diana Perales, Central New Mexico Community College

Arabidopsis thaliana have been transformed to over-express the photorespiratory enzyme, glycine decarboxylase (GDC-L). Our research was to evaluate the photosynthetic activity of *Arabidopsis thaliana*. For more than 30 years, photorespiration has been considered to be a wasteful process, requiring plants to use energy and release CO_2 in order to recycle one of the products of oxygen fixation by the photosynthetic enzyme RuBisCO. This side reaction partly reverses the major action of RuBisCO, the capture of CO_2 for the Calvin cycle in photosynthesis. Yet, these transformed plants suggest that photorespiration can be beneficial due to the increased expression of the enzyme GDC-L and increased rate of photosynthesis. We investigated how photosynthesis was increased. Specifically, to see if this was achieved through increased expression or activation of RuBisCO in response to the increased expression of GDC-L. Our research was performed by analyzing the RuBisCO activity and measuring the photosynthesis responses under multiple light exposures in both the wild type and the transformed plant (PSL-3). We found during the RuBisCO analysis, the wild type had more activity and higher photosynthesis than PSL-3. This should represent that there is more RuBisCO present in wild type than in PSL-3 but there is other data from our collaborators lab that contradict this idea. Additional data is needed to resolve the discrepancies between the two labs. It is possible that leaf and plant age varied between experiments and is responsible for the different results.

Keywords: Photosynthesis, enzymes, Arabidopsis thallana, CO_2

Session D: Influences on Water Quality

Moderator: Kurt Anderson, NMAS

Room: Enchantment A & B

Uranium capture on modified inorganic-organic graphite hybrid material to develop a specific uranium binding filtrate for mining reclamation and private water uses

Samantha Saville, New Mexico Tech

Uranium has a significant impact on life in several Western states including New Mexico. The EPA in 1991 proposed the uranium standard for drinking water to be 30 ppb (EPA 1991) but groundwater in uranium-rich areas can range up to 120 ppb (Langmuir 1997). This creates a large problem in New Mexico because most drinking water comes from sources that can be contaminated with high uranium concentrations. Removal of uranium by binding to a subsequently-separable solid is becoming a highly sought technology in industry and uranium research. A new inorganic-organic hybrid material based on carbon for uranium capture has been developed by Dr. Liliya Frolova in the Chemistry Department at New Mexico Institute of Mining and Technology. This material was tested for its percent absorption of uranium, selectivity towards uranium over other common divalent cations, and the materials reusability, durability, and absorption recovery for continued use as filter material. These tests were performed on an inductively coupled plasma mass spectrometer. Surface analysis was accomplished using a scanning electron microscope, particle size analysis was completed with a traditional microscope, and filter prototypes were accomplished with Darcy's Law equation. The

various prototypes can be developed for pressure systems, non-electric systems, larger scale models for industrial use, including remote locations that need it the most. Our hybrid material shows a tenfold increase of uranium absorption over both calcium and magnesium (0% Ca, 0% Mg, 99.96% U) which is a significant increase over the unmodified material (18.14% Ca, 0.32% Mg, 29.34% U).

Keywords: Water quality, graphite, uranium, filtrate, absorption

Elemental Concentrations in Wildfire Ash

Natalie Correa, University of New Mexico

Hypothesis: *Metals are concentrated in ash and their presence and speciation varies as a function of different tree species*. Questions: What specific metal and non-metal elements are contained in wildfire ash and how much metal and nonmetal elements do different tree species contain? Long term: What could potentially happen when an excess of metals from wildfire ash enters freshwater ecosystems and what are some toxic metals to humans? Determine the concentration of metals and anions leached from solid ash from the Valles Caldera Natural Preserve. The following six tree species from the Valles Caldera Natural Preserve have been sampled for this study: Quaking Aspen, Blue Spruce, Western Juniper, Ponderosa Pine, Douglas Fir, and Gambel Oak. The ash samples were put through acid digestions (Aqua Regia) and metals were analyzed using Inductively coupled plasma-optical emission spectroscopy and the anions were measured using the mass spectroscopy.

Keywords: Heavy metals, wildfire ash, pH, water quality

Effect of intermittent flow on metals mobilized from Native American abandoned uranium mine waste sites

Sumant Avasarala, University of New Mexico

Column experiments were conducted to study the effect of intermittent flow on the mobility of metals from abandoned uranium mine waste sites in Blue Gap Tachee (BGT), AZ and Laguna, NM during surface water infiltration to ground water resources. Intermittent flow represent the rainfall patterns in the southwestern United States, involving alternate wet and dry cycles. In order to simulate these rainfall patterns shorter wet periods of 15, 30, 60, 120 and 360 minutes, followed by longer dry periods of 24 hours, were adopted for the column experiments. The experiment involved sequential leaching of sediments from Laguna and BGT with 18M'Ω water (pH 5.4), Synthetic Rain Water (SRW, pH 5.6), 10mM bicarbonate solution (pH 7.9) and 10mM acetic acid (pH 3.4) solution that represent the environmentally relevant conditions as witnessed in BGT water samples (pH 3.8 and 7.4). With just 18M'Ω water and SRW almost 90 µg/L of U, 4500 µg/L of V and 20 µg/L of As were released from BGT mine waste while the Laguna sample showed the release of 380 µg/L of U, 2 µg/L of V and 40 µg/L of As. The released U concentrations were 3-13 times its EPA MCL for U which under natural circumstances could threaten the proximate communities. Bicarbonate and acetic acid extractions on the other hand released 3500-6000 µg/L of U, 50-3000 µg/L of V and 14-35 µg/L of As from both Laguna and BGT mine waste respectively. A 1D reactive transport model is also being applied to better interpret the role of these interplaying mechanisms.

Keywords: Uranium, heavy metals, mine waste, Blue Gap, rainfall, intermittent flow

Spectroscopic investigation of interfacial interaction of organic compounds and manganese oxides

Nabil Shaikh, University of New Mexico

Water reuse has become a necessary practice in semi-arid regions. However, a new generation of emerging organic micropollutants has been increasingly scrutinized in water sources. The oxidation of organic micropollutants by

reaction with manganese oxides [MnO_x] has been widely studied but little is known about the changes in chemical characteristics of the MnO_x surfaces. We investigated the oxidation of phenol, aniline and triclosan with MnO_x using X-ray Photoelectron Spectroscopy for surface analysis and ICP-Mass Spectroscopy for liquid analysis. The surface of unreacted MnO_x and reacted MnO_x were examined for variations in Mn oxidation state and carbon/oxygen bonding. The solution were analyzed for soluble Mn. Reaction of phenol with MnO_x resulted in increase in C-OH bonds, indicating the presence of phenol and its polymeric by-products. Detection of chlorine after reaction with triclosan, suggests that triclosan and its by-products are associated to MnO_x surface. The increase in aromatic and aliphatic carbon bonds after reaction with aniline suggests that aniline and its byproducts are also associated to MnO_x surface. An increase of Mn(III) on surface and dissolution of Mn into solution was detected for MnO_x reacted with organics, indicating reduction of MnO_x. Different changes in the MnO_x surface was observed among the organic compounds, indicative of differing mechanism or pathways of surface reactions for different organic groups. The results from this research are important towards better understanding biogeochemistry of Mn, and for development of cost-effective water treatment technologies that make use of MnO_x to remove emerging organic micropollutants.

Keywords: water, emerging contaminants, surface analysis

The fate of metals near abandoned uranium mine wastes

Cherie DeVore, University of New Mexico

The legacy of uranium mining activities in New Mexico has resulted in a number of abandoned mine sites that have not been adequately managed or remediated. An investigation of the chemical interactions and mobility of uranium (U) near abandoned mine wastes was performed at a site located in Laguna Pueblo, New Mexico. Compared to the U.S. EPA drinking water standard of 30 µg/L, elevated U concentrations (ranging from 65 to 710 µg/L) were observed in surface water below an abandoned uranium mine using inductively coupled mass spectrometry (ICP-MS). These U concentrations seasonally decrease (5.77-10 µg/L) downstream at a reservoir five kilometers below the mine. Our water data suggest that U forms aqueous complexes with carbonate and calcium which could contribute to U mobility. Although U concentrations in stream water are high, acid digestions (performed using hydrochloric and nitric acid) and X-Ray Fluorescence bulk analysis suggest that there is limited accumulation in stream bed and bank sediments. Additionally, individual samples show high U concentrations (20-55 mg/kg) in the roots of salt cedar plants near the mine site and translocation to the stems and leaves is minimal. Our results suggest that uptake by plants, and U sorption to wetland sediments are the dominant factors that help to decrease the U concentrations downstream of the mine. This study contributes to an understanding of the mobility of uranium in surface water and sediments close to the mine waste. This information is essential to determine human health implications resulting from exposure to these metals in neighboring communities.

Keywords: Metals, uranium, water quality, spectroscopy

Session E: Education, Health, and the Economy

Moderator: Jason Jackiewicz, NMSU

Room: Enchantment E & F

The economic impacts of wildfires on the built and natural critical civil infrastructure

Natalia Sanabria, University of New Mexico

The impacts on critical civil infrastructure (e.g., water, telecommunications, transportation, etc.) due to major disaster events, can greatly affect the response times and effectiveness of emergency teams, the proper operation of critical facilities and the recovery time for the community. With natural disasters on the rise and the nation's infrastructure outdated and vulnerable, it is essential for agencies to have a plan of action for the allocation of funds to protect

civil critical infrastructure. Over the past decades, wildfires have increased in severity and frequency in response to changes in climate, especially in the Southwest where the arid climate, heat waves and droughts can have a dramatic effect on the risk of fire. This study explores the economic impacts of wildfire events on critical civil infrastructure and the costs associated to mitigation strategies. The proposed impact assessment framework can be incorporated in the decision making processes of watershed managers in order to consider the proper wildfire risk mitigation strategies that better protect and maintain the functionality of the infrastructure.

Keywords: wildfire, economic impacts, critical infrastructure

The Cancer Breathalyzer: Chemical strips that detect chemicals in lung cancer 'breathprint'

JT Goodart, Grants High School

Every year, thousands of people are diagnosed with lung cancer. 85% of patients are diagnosed at a late stage with only a 4% survival rate when diagnosed late. The purpose of this project is to make chemical strips for testing in a modified breathalyzer to detect lung cancer at an earlier stage based on chemicals released in a high concentration in lung cancer 'breathprints'. The experiment was conducted in four phases. Phase I, yeast cultures were grown in lung cancer breathprint chemicals for the chemicals to be released through fermentation combined with CO_2. The yeast's ability to survive was measured through density, pH, cell size, and growth. Phase II, chemical strips were made that changed color when exposed to chemicals yeast cultures released by direct liquid contact and constant or alternating aromatic exposure. Color changes, if any, were recorded. In Phase III, further testing was performed using chemicals that modeled aspects of the reaction between the strips and yeast to determine the color-changing agent and increase the rate, concentration, and color change. The color change was recorded. Phase IV, the pH of the strips was measured after exposure to the chemicals in order to determine the reactions occurring. After all data was gathered, color key charts were made that displayed the color change with respect to quantities of chemicals present. The rate of color change was calculated. A cost analysis between the potential breathalyzer and current methods of lung cancer tests was made. In conclusion, the project was successful in making it more possible to develop a breathalyzer for detecting lung cancer.

Keywords: cancer, cells, health care, breathprint, CO_2

Information technology experiences using simulated tele-science exploration of Mars

Nader Vadiee, Southwestern Indian Polytechnic Institute

To promote the advancement of Native American students in Information Technology (IT) and Science, Technology, Engineering and Math (STEM) careers Southwestern Indian Polytechnic Institute (SIPI) will develop a year-round robotics centered IT immersion program that will provide students a stimulating learning environment to explore their curiosity and creativity in IT and STEM fields. To expand the impact of the program and the number of students reached, SIPI will partner with three regional high schools with predominantly Native American student populations. This project will become a model program through which experience gained can be shared with other Tribal Colleges (TCU) through the TCU Engineering Programs Working Group. The robotic elements of this program will focus heavily on performing remote science operations, akin to the Mars Exploration Rovers, to provide an interesting and technically rich IT environment for student learning. Students will get hands on experience in operating robots from remote locations to emphasize the importance of computers for computation and control, and communication networks to transmit and receive information. Additionally students will work directly with robots to configure and program them with various scientific and technology payloads. The concepts of systems integration will be learned through these experiences to create a big-picture understanding of how IT infrastructure impacts scientific and technology systems.

Keywords: Robotics, LEGO engineering mechanisms, STEM education, STEM careers, diversity

Evolution of a paraprofessional delivered diabetes education project in the South Valley

Fadi Jamaleddin, University of New Mexico

Diabetes-related disparities are evident in New Mexico and the South Valley. This study evaluated diabetes patient literacy and medication adherence and the effects of 3 months of telephone support by clinic paraprofessionals. Data were self-reported at baseline and 3 months and compared using the Chi-square test. At baseline (n=37), 37% of patients had low literacy, 50% had possibility of low literacy, and 13% had adequate literacy. Fifty-eight percent of patients (n=33) reported high medication adherence, 24% medium adherence and 18% low adherence. From baseline to 3 months, self-rated health and understanding of benefits of blood sugar control significantly changed.

Keywords: Diabetes, health care, education, patient literacy

Emerging air quality issues in New Mexico and the West

Kip Carrico, New Mexico Tech

Despite lingering local problems, U.S. efforts over the past several decades to control air pollution emissions have been strikingly successful in improving ambient air quality. Contrastingly, emerging southwest US regional trends demonstrate increasing, episodic impacts from biomass smoke and soil dust aerosols. Though biomass smoke and dust are traditionally considered from 'natural' sources, stronger links to a changing climate and other human perturbations are becoming increasingly clear. The presentation will discuss such trends and present specific results on the detailed physical properties of smoke and dust aerosols and their significance. The size distribution, light scattering, and light absorbing properties of aerosol particles play a vital role in determining aerosol impacts. Such aerosol physical properties, and their relation to external influences such as humidity and combustion characteristics, determine the resulting aerosol impacts on human health, visibility, atmospheric chemistry and significance to climate.

Keywords: climate, air quality, climate change, aerosol impacts

Session F: Chemistry and Solar Power

Moderator: Donivan Porterfield, LANL

Room: Enchantment E & F

Contribution of Scys-Mo interaction in sulfite oxidase family enzymes

Chao Dong, New Mexico State University

The sulfite oxidase enzymes are important in the metabolism of sulfur for biology systems. The conserved cysteine c207, forming coordination sphere of molybdenum, is vial to the enzyme reactivity. It is proposed to adjust the reduction potential of redox orbital through Mo(dx2-y2)-Scysteine covalency by change in Ooxo-Mo-Scysteine-C dihedral angle. The model complexes that mimic of cysteine ligand in the active site possessing ~90° Ooxo-Mo-Scysteine-C dihedral angle present in the crystal structure of SO enzymes. Electronic absorption, magnetic circular dichroism and resonance Raman spectroscopies in combination with bonding calculations are employed to probe the nature of Mo(dx2-y2)-Scysteine covalency. The results indicates that poor covalency between Mo(dx2-y2)-Scysteine is responsible for gmax<ge in SO enzymes, most of all, which causes no gmax shift to low magnetic field by seleno-subtituted sulfur cysteine in human SO enzyme at high pH.

Keywords: model complexes, sulfite oxidase, enzymes, chemistry

Distortion induced acceleration of intersystem crossing

Ranjana Dangi, University of New Mexico

Control of molecular excited state processes is important for understanding how to fully realize the potential of the molecular photonics and electronics fields. In order to obtain insight into atomic and vibronic level control of excited state lifetimes, we have initiated a study of new diimine platinum(II) dichalcogenolenes that possess charge-separated dichalcogenolene --> diimine excited states. Square planar (dichalcogenolene)Pt(diimine) complexes have garnered considerable interest due to their rich photophysical properties, including their photoluminescence behavior. We use a combination of electronic absorption and transient spectroscopies, spectroscopic calculations, and group theoretical arguments to understand the remarkable dependence of excited state lifetimes on (1) the heteroatoms of the dichalcogenolene ligand, and (2) static distortions related to the acceptor ligand. Our results indicate that anisotropic covalency and low-symmetry distortions control spin orbit and vibronic spin orbit coupling, and these are the origin of enhanced T_1 --> S_0 intersystem crossing in these systems. Of particular interest is (dithiolene)Pt(biquinoline), which possesses a T_1 --> S_0 lifetime that is nearly two orders of magnitude less than that observed for (dithiolene)Pt(bipyridine). This is due to a strong static distortion driven spin-orbit coupling contribution that can be used to evaluate vibronic spin orbit coupling contributions to the T_1 --> S_0 lifetimes of other (dichalcogenolene)Pt(diimine) complexes.

Keywords: dithiolene, diimine, platinum, photoluminescence, electronic structure

Interchain charge transfer states mediate triplet formation in polymer nanofibers

Alan Thomas, University of New Mexico

Supramolecular aggregates of poly-(3-hexylthiophene) (P3HT) can adopt varying structural conformations with different electronic coupling depending upon aggregation conditions. The electronic coupling between chromophores in these aggregate "nanofibers" ranges from primarily interchain (H-aggregation) to primarily intrachain (J-aggregation) coupling, with a wide range of intermediary or mixed couplings possible. By placing nanofibers of all different types of coupling in an inert matrix at low concentrations and sandwiching this matrix in between conducting electrodes, we are able to monitor the photoluminescence (PL) of individual nanofibers at varying timescales, from ultrafast to steady-state, with and without the presence of an external electric field. We find that J-aggregate nanofibers show a size (molecular weight) dependence on quenching and PL, as well as a susceptibility to an external electric field while H-aggregates do not. We demonstrate that even though J-aggregate nanofibers possess primarily intrachain coupling between chromophores, and these fibers have also been shown to efficiently generate triplets, the primary source of initial triplet generation is due to interchain coupling and charge transfer states between fibers. This knowledge is useful for understanding the relationship between polymer structure and electronic properties in the solid state and can be used to guide the rational design of organic electronic devices.

Keywords: charge transfer states, polymers, nanofibers, photoluminescence

Functional polymers derived from trans-enediyne monomers

Keda Hu, University of New Mexico

Conjugated polymers have attracted great research interests due to their tunable optoelectronic properties and increasing applications in organic electronic devices including sensors, diodes and photovoltaics. Among a plethora of examples, non-aromatic all-carbon main-chain polymers including polydiacetylenes (PDAs) and polytriacetylenes (PTAs) represent a unique class of conjugated polymers and have been considered intermediate states transitioning from polyacetylenes (PAs) and the still elusive carbon allotrope, carbyne. We have recently developed facile methods for the synthesis of a series of trans-enediyne (EDY) monomers bearing various functional groups at the double

bonds. These EDYs have been applied in the synthesis of novel PDAs, PTAs and platinum segmented PDAs that are hardly accessible through conventional methods. Physical and electronic properties of these polymers can be easily fine-tuned through varying the substituents that are directly conjugated to the main-chains and their applications in organic photovoltaics (OPVs) have been explored.

Keywords: enediynes, polydiacetylenes, polytriacetylenes, platinum segmented polydiacetylenes, organic photovoltaics

Molecular breakwater-like tetrapods for organic solar cells

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Most small conjugated molecules applied in solar cells have linear structures containing multiple aromatic groups connected in series. However, unfavorable film forming ability and grain boundaries both originated from high crystallinity of linear small molecules are detrimental to device performances. As a result, 3-D structures, breakwater-like tetrapods are especially interesting owing to their unique ability to mutually interlock, which prevents dislodging and provides high structural stabilities. Herein, we synthesize and characterize two tetrapodal breakwater-like small molecules, SO and SFBTD, as shown below. Absorption, X-ray scattering and differential scanning calorimetry experiments indicate crystalline nature of these compounds but slow crystallization kinetics. Solar cells employing SO or SFBTD and phenyl-C_{61}-butyric acid methyl ester (PCBM) were fabricated and evaluated. Relatively low performance was obtained mainly due to the lack of appropriate phase separation, which was caused by molecularly mixed blends with PCBM. Addition of poly(thienylene vinylene) (PTV), a low bandgap highly crystalline conjugated polymer, into the SO/PCBM blend was found to induce appreciable phase separation. Such ternary blend devices showed cooperatively improved performances over binary devices employing either SO or PTV alone. Our findings can give useful insight on the structure-property relationships of such 3-D small molecules and their applications in organic solar cells.

Keywords: tetrapodal molecule, solar cell, crystallinity and phase separation

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