CEP Regular Meeting
New Scripps Seismic Research &
Introduction of Decommissioning General
Contractor (DGC)
Thursday, February 16, 2017
from 5:30 - 8:30 p.m.
Dana Point, California
Have a comment?
Write to:
nuccomm@songs.sce.com
New CEP Members

Welcome!

Hon. Martha McNicholas
President, Board of Trustees
Capistrano Unified School District

Hon. Paul Wyatt
Mayor Pro Tem
City of Dana Point City Council
Decommissioning Update

February 16, 2017

Tom Palmisano
Vice President Decommissioning & Chief Nuclear Officer
Decommissioning Principles

Safety
Stewardship
Engagement

For more information on SONGS visit www.SONGScommunity.com
NRC ACTIVITIES
## NRC Submittal Status

<table>
<thead>
<tr>
<th>Item</th>
<th>Submittal Status</th>
<th>Approval Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>License Amendment Request Extend Cyber Security Program Milestone 8</td>
<td>Submitted June 16, 2016</td>
<td>Approved January 23, 2017</td>
</tr>
<tr>
<td>Exemption* Request Offsite Insurance</td>
<td>Submitted September 2015</td>
<td>Forecast 2Q 2017</td>
</tr>
<tr>
<td>Exemption* Request Onsite Insurance</td>
<td>Submitted October 2015</td>
<td>Forecast 2Q 2017</td>
</tr>
<tr>
<td>ISFSI Only License Amendment Request Tech Specs, Emergency Plan, Security Plan</td>
<td>Submitted December 2016</td>
<td>Forecast 2Q 2018</td>
</tr>
</tbody>
</table>

*Exemption is how the NRC currently handles a change in the regulatory status for decommissioning plants
## 2017 NRC Inspections

<table>
<thead>
<tr>
<th>Inspection</th>
<th>Date</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st QTR Decommissioning</td>
<td>Jan 30 – Feb 2</td>
<td>No violations</td>
</tr>
<tr>
<td>Ongoing ISFSI Construction Inspections</td>
<td>April 3-4 (next inspection)</td>
<td>No findings to date from previous inspections</td>
</tr>
<tr>
<td>Security Access Control</td>
<td>April 17-21</td>
<td>-</td>
</tr>
<tr>
<td>2nd QTR Decommissioning</td>
<td>May 22-25</td>
<td>-</td>
</tr>
<tr>
<td>3rd QTR Decommissioning</td>
<td>August 28-30</td>
<td>-</td>
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</tbody>
</table>
ISFSI Project Expansion
CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA) UPDATE
Environmental Impact Report
State Lands Commission Process

In Process

*Tentative schedule
Decommissioning General Contractor (DGC) Selection

• Major decommissioning work to be performed by 3rd party decommissioning contractor (DGC)
• SONGS Decommissioning Solutions selected as DGC via competitive bid process
• Joint venture of AECOM and EnergySolutions
SONGS Decommissioning Solutions (SONGS DS)

February 16, 2017
Matt Marston
Senior Vice President, Operations
Union of AECOM and URS created unique contractor with integrated project services
- project management
- planning and permitting
- engineering, design, procurement
- construction and D&D
- Engineering News-Record 2015
  - #1 Top Design Firms
  - #2 Top 200 Environmental Firms
  - #2 Top 50 Program Managers
  - #7 Top 400 Contractors Overall
- Past Performance relevant to SONGS
  - Reactor head and steam generator replacement projects such as Diablo Canyon and St. Lucie

**SONGSDS**

**Predictability in Outcome**

- Safety certainty
- Regulatory certainty
- Cost certainty
- Schedule certainty

**Only 1**

licensee decommissioning first U.S. two-unit nuclear power facility

**5**

commercial nuclear power
License Termination Plans

**34**

large component replacement projects

200,000,000 ft³ LLW disposed at owned disposal sites

>25,000,000 ft² nuclear facility D&D

- Largest U.S. nuclear waste company
- Privately-owned rail/trucking, logistics, processing, and disposal facilities
- Fleet of over 1,000 railcars and 2,500 bulk containers
- Regulatory-aligned waste perspective from experience as licensee at Zion
- Timely Past Performance relevant to SONGS
  - SONGS Decommissioning Cost Estimate
  - SONGS Radioactive Waste Management
  - Zion Nuclear Station, licensee for full scope D&D
- Key personnel who have over 350 years of combined nuclear experience and 250 years combined nuclear D&D experience
- Experienced executive leadership team
- A seasoned team skilled in transitioning operations to D&D
- A proven low-profile D&D approach that completes the project safely, compliantly, and within 10 years
- Holder of 10 CFR 50 License at Zion
New Analysis of Seismic Faults near San Onofre

February 16, 2017

Tom Palmisano
Vice President, Decommissioning & Chief Nuclear Officer
Objectives

- Review purpose of the seismic research
- Summarize SONGS original seismic design basis, subsequent seismic studies
- Summarize ISFSI seismic design basis
- Preview new Scripps seismic studies
California Energy Commission (CEC) Seismic Directive

- In 2010, CEC directed SCE to evaluate seismic faults that could impact SONGS operation/reliability
  - Codified in Assembly Bill 1632
  - Requested evaluation of relevant seismic data
  - Directed SCE to conduct new research
SONGS Plant
Seismic Design Basis

• Seismic design criteria for San Onofre based on:
  – Extensive geological and seismic studies
  – Evaluation of earthquakes having Richter magnitude 5.0 and greater within 200 miles
  – Largest site acceleration caused by magnitude 7.0 quake at Newport Inglewood/Rose Canyon (NI/RC) fault system
  – Translated to peak ground acceleration (PGA) of 0.63g at San Onofre

• Plant designed to withstand PGA of 0.67g with NRC approval
## Interim Activities

<table>
<thead>
<tr>
<th>Timing</th>
<th>Developments / Evaluations / Findings</th>
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<tbody>
<tr>
<td>2000</td>
<td>Oceanside Blind Thrust (OBT) fault postulated beneath San Onofre</td>
</tr>
<tr>
<td>2001</td>
<td>ISFSI designed to increased PGA of 1.5g</td>
</tr>
<tr>
<td>2001</td>
<td>SCE study of postulated OBT fault, determines seismic risk does not appreciably change</td>
</tr>
<tr>
<td>2002</td>
<td>NRC agreed with SCE’s OBT conclusion</td>
</tr>
<tr>
<td>2010</td>
<td>SCE updates seismic hazard analysis considering 7.5 magnitude earthquake from NI/RC plus OBT</td>
</tr>
<tr>
<td>2010</td>
<td>Found that seismic risk was bounded by previous results approved by NRC</td>
</tr>
</tbody>
</table>
Summary

• SCE / Scripps will complete analyses required of SCE by CEC early 2017
• SONGS ISFSI seismic design highest in U.S.
• More recent seismic hazard analysis show no appreciable increase in risk to San Onofre
Characterizing the Seismic Setting Offshore Southern California

February 16, 2017

Dr. Neal Driscoll (SIO)
Scripps Institution of Oceanography
Characterizing the Seismic Setting 
Offshore Southern California

Neal Driscoll (SIO) and Graham Kent (UNR)

Shannon Klotsko, Alistair Harding, James Holmes, Valerie Sahakian, Mackenzie Roberts, Leanne Hirsh, George Murray, Jillian Maloney (SIO)

Annie Kell, Steve Wesnousky, Jayne Bormann, Mounira Boudjema, John Louie (UNR)

Crews of the R/V Melville, R/V New Horizon, R/V Sproul, R/V Thompson
Outline

• Assessing alternative models for recent offshore deformation and seismic hazard - Hypothesized Oceanside Blind thrust vs. segmented strike-slip faults
• Characterization of the Newport Inglewood/Rose Canyon Fault segmentation, rupture implications
• Near and far-field Tsunami Hazard for the Inner California Borderlands
Seismic Sources for SONGS
Regional Fault Distance from SONGS

San Andreas - 92 km, 57 miles
San Jacinto - 70 km, 43 miles
Elsinore - 38 km, 24 miles
Newport-Inglewood/Rose Canyon (NIRC) - 8 km, 5 miles
Hypothesized Oceanside Blind Thrust - 7 km, 4.3 miles
Palos Verdes/Coronado Bank - 32 km, 20 miles
San Diego Trough - 46 km, 29 miles
San Clemente - 94 km, 58 miles
Compression due to horizontal shortening

Right-lateral strike-slip

Blind thrust

Horizontal motion with little vertical deformation
The recent deformation observed offshore has been explained by (1) a hypothesized blind thrust - Oceanside Blind Thrust (OBT) or (2) releasing and constraining bends along segmented strike-slip fault systems.
Geometry and extent of the hypothesized Oceanside Blind Thrust
Geometry of segmented strike slip faults

Inner California Borderlands

Offshore faults are segmented
**Approach to test between the two hypothesis**

100 days of geophysical data collection

New data includes:

- Multibeam Bathymetry collected with the USGS


- 4500 line-km regional grid of 2D high-resolution sparker MCS reflection data
- 100 sq. km of high-resolution 3D data

Additional data includes:

- 2000 line km of reprocessed chevron data

- high-resolution and legacy industry datasets from USGS archives

Nested depth resolution and density of these datasets allow us to image faults in the ICB at an unprecedented scale.
Observations based on Offshore Seismic Surveys

(1) Onlapping sequences reveal that the deformation becomes younger toward the east

(2) Transport of ‘Monterey’ blocks is toward the south/southwest

(3) Localized regions of compression and extension

(4) Basin depth increases above Catalina basement markedly toward the south

Offshore observations are not consistent with predictions of the hypothesized Oceanside Blind Thrust.
Offshore observations are consistent with the predictions of a segmented strike-slip model.
One example of offshore observations:

Line 4515 shows that block movement is toward the south not to the west as predicted by the hypothesized Oceanside Blind Thrust
Rotated sequence

fluids?
Summary - Seismic Sources

• Observations based on the offshore seismic surveys are not consistent with the predictions of the hypothesized Oceanside Blind Thrust (OBT) model.

• Observations are consistent with the segmented strike-slip fault model.

• These results suggest the hazard for coastal regions in southern California is reduced because the slip (0.62 mm/yr) on the purported OBT does not exist.

• In addition, there will be no potential hangingwall effects on ground motion or tsunamigenic hazards associated with the OBT.
Mw 6.4 1933 Long Beach

Rose Canyon: 1650 AD +/- 120 years

0.5 - 2 mm/yr

Stepovers are 2 kilometers or less in width.
<table>
<thead>
<tr>
<th>Rupture Scenario</th>
<th>Strands</th>
<th>Total Rupture Length</th>
<th>Wells-Coppersmith Slip: 0.5 m μ: 20 GPa</th>
<th>Wells-Coppersmith Slip: 0.5 m μ: 45 GPa</th>
<th>Wells-Coppersmith Slip: 2 m μ: 20 GPa</th>
<th>Wells-Coppersmith Slip: 2 m μ: 45 GPa</th>
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</thead>
<tbody>
<tr>
<td>Scenario I</td>
<td>S1</td>
<td>8 km</td>
<td>M 5.7 ± 0.11</td>
<td>M 6.0</td>
<td>M 6.2</td>
<td>M 6.4</td>
</tr>
<tr>
<td>(La Jolla strand – Fig 11)</td>
<td></td>
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</tr>
<tr>
<td>Scenario II</td>
<td>S1, S2, S3, S4, S5 (1/2 slip on S4 and S5)</td>
<td>125 km</td>
<td>M 7.3 ± 0.16</td>
<td>M 6.7</td>
<td>M 6.9</td>
<td>M 7.1</td>
</tr>
<tr>
<td>(All strands – Fig 12)</td>
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</tr>
<tr>
<td>Scenario II b</td>
<td>S1, S2, S3, S4, S5, S, LA (1/2 slip on S4 and S5)</td>
<td>158 km</td>
<td>M 7.3 ± 0.16</td>
<td>M 6.7</td>
<td>M 7.0</td>
<td>M 7.1</td>
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<tr>
<td>(4 strands + Northern onshore segment)</td>
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<tr>
<td>Scenario III</td>
<td>S2, S3, S4</td>
<td>89 km</td>
<td>M 7.2 ± 0.16</td>
<td>M 6.6</td>
<td>M 6.9</td>
<td>M 7.0</td>
</tr>
<tr>
<td>(4 strands – Fig 13)</td>
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</table>
Based on water depth, radiocarbon dating, and sediment rates, the segment of the NI/RC fault offshore SONGS has not ruptured since ~10,500 - 13,600 BP.

Onshore and offshore data suggest that all segments of the NI/RC have not ruptured together in the past.

Summary - NI/RC Fault

• Four main fault strands of the NI/RC fault are identified, separated by three main stepovers along strike, all of which are 2 kilometers or less in width.

• Based on the new mappings and segment offsets, the offshore portion of the NIRC fault zone could, depending on rupture characteristics, produce an earthquake of up to magnitude Mw 7.3, or Mw 7.4 if a northern onshore segment is included.

• Onshore and offshore data indicate that all segments of the NI/RC have not ruptured together in the past
Tsunami Hazard along the Inner California Borderlands: near vs far field sources
Offshore bathymetry in the CA Borderlands consists of numerous shallows and deeps, which interferes with incoming tsunami waves. The offshore bathymetry acts as a natural baffle to tsunami waves.
Evidence for near-field tsunamigenic slope failures

New high resolution seismic and bathymetry data show no signs of past large slope failures that could be tsunamigenic.
Summary - Tsunami Hazard

• The irregular bathymetry of the Inner California Borderlands acts as a natural baffle to far-field tsunamis.

• Potential near-field tsunamis sources are engendered by earthquakes on local fault systems or by slope failure

• The largest historical tsunami wave height in California was 4.5 m, reported in October 1868 in the San Francisco Bay region.
Implications of Findings for San Onofre

- Findings support reduced seismic risk at San Onofre
  - Hypothesized Oceanside Blind Thrust fault not supported
  - Data indicates all segments of the Newport-Inglewood/Rose Canyon (NI/RC) fault have not ruptured together in the past
  - If all segments of the NI/RC rupture, could generate up to 7.3 or 7.4 magnitude earthquake, which is less than the magnitude 7.5 used in the latest seismic hazard analysis
  - Near-field tsunami risk reduced without OBT
  - Large far-field tsunamis baffled by California Borderlands
- Seismic design of spent fuel pools consistent with new research
- ISFSI design provides greater margin given reduced seismic risk
  - SONGS ISFSI seismic design is highest in U.S.
BREAK
CEP General Updates
Update

• Consolidated Interim Storage (CIS)
• State-level Transportation Planning

David Victor, Chairman
CEP Membership

Thank you for your service!

Dr. William Parker
University of California, Irvine
# 2017 Upcoming Topics

## CEP Meetings

<table>
<thead>
<tr>
<th>Topic</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consolidated Interim Storage (CIS) Vendors</td>
<td>May 11</td>
</tr>
<tr>
<td>Bi-Partisan Policy Center (BPC) Update on Consent-Based Siting</td>
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<tr>
<td>Nuclear Regulatory Commission (NRC) Inspections</td>
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<tr>
<td>Spent Fuel Transportation</td>
<td>Aug. 17</td>
</tr>
<tr>
<td>Spent Fuel Management &amp; Defense-in-Depth (DID)</td>
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<tr>
<td>Easement &amp; Leases</td>
<td>Oct. 26</td>
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<tr>
<td>Department of the Navy</td>
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<tr>
<td>End-state of Land</td>
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*Topics subject to change*
Public Comment

Submit written comments to:
nuccomm@songs.sce.com
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>C&amp;D</td>
<td>Cold &amp; Dark</td>
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<tr>
<td>CCC</td>
<td>California Coastal Commission</td>
</tr>
<tr>
<td>CDP</td>
<td>Coastal Development Permit</td>
</tr>
<tr>
<td>CEC</td>
<td>Cavity Enclosure Container</td>
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<tr>
<td>CEP</td>
<td>Community Engagement Panel</td>
</tr>
<tr>
<td>CEQA</td>
<td>California Environmental Quality Act</td>
</tr>
<tr>
<td>CIS</td>
<td>Consolidated Interim Storage</td>
</tr>
<tr>
<td>CPUC</td>
<td>California Public Utilities Commission</td>
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<tr>
<td>CSLC</td>
<td>California State Lands Commission</td>
</tr>
<tr>
<td>D&amp;D</td>
<td>Decontamination &amp; Dismantlement</td>
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<tr>
<td>DA</td>
<td>Decommissioning Agreement; Decommissioning Agent</td>
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<tr>
<td>DCE</td>
<td>Decommissioning Cost Estimate</td>
</tr>
<tr>
<td>DDT</td>
<td>Decommissioning &amp; Dismantlement Team</td>
</tr>
<tr>
<td>DGC</td>
<td>Decommissioning General Contractor</td>
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<tr>
<td>DID</td>
<td>Defense-in-Depth</td>
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<tr>
<td>DOE</td>
<td>Department of Energy</td>
</tr>
<tr>
<td>DSAR</td>
<td>Defueled Safety Analysis Report (replaces FSAR)</td>
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<tr>
<td>DSC</td>
<td>Dry Storage Canister</td>
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<tr>
<td>D-SEIS</td>
<td>Draft Supplemental Environmental Impact Statement</td>
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<tr>
<td>D-SER</td>
<td>Draft Safety Evaluation Report</td>
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<tr>
<td>DTF</td>
<td>Decommissioning Trust Fund</td>
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<tr>
<td>EIR</td>
<td>Environmental Impact Report</td>
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<tr>
<td>EP</td>
<td>Emergency Plan</td>
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<td>EPRI</td>
<td>Electric Power Research Institute</td>
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<tr>
<td>GEIS</td>
<td>Generic Environmental Impact Statement</td>
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<td>IFMP</td>
<td>Irradiated Fuel Management Plan</td>
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<td>ISFSI</td>
<td>Independent Spent Fuel Storage Installation</td>
</tr>
<tr>
<td>LAR</td>
<td>License Amendment Request</td>
</tr>
<tr>
<td>LOED</td>
<td>Large Organism Exclusion Device</td>
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<td>MARSSIM</td>
<td>Multi-Agency Radiation Survey Site &amp; Investigation Manual</td>
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<tr>
<td>MOU</td>
<td>Memorandum of Understanding</td>
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<tr>
<td>NDCTP</td>
<td>Nuclear Decommissioning Cost Triennial Proceeding</td>
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<td>Nuclear Decommissioning Trust Fund</td>
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<td>NEI</td>
<td>Nuclear Energy Institute</td>
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<td>NEPA</td>
<td>National Environmental Policy Act</td>
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<tr>
<td>NOP</td>
<td>Notice of Preparation</td>
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<td>NRC</td>
<td>Nuclear Regulatory Commission</td>
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<td>PDEP</td>
<td>Permanently Defueled Emergency Plan</td>
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<td>PSDAR</td>
<td>Post-Shutdown Decommissioning Activities Report</td>
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<tr>
<td>REIR</td>
<td>Request for Environmental Impact Review</td>
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<td>SCE</td>
<td>Southern California Edison</td>
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<td>SFP</td>
<td>Spent Fuel Pool</td>
</tr>
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<td>SFPI</td>
<td>Spent Fuel Pool Island</td>
</tr>
<tr>
<td>SLC</td>
<td>State Lands Commission (CA)</td>
</tr>
<tr>
<td>SONGS</td>
<td>San Onofre Nuclear Generating Station</td>
</tr>
<tr>
<td>VCT</td>
<td>Vertical Canister Transporter</td>
</tr>
</tbody>
</table>
Peer-Reviewed Seismic Studies

• *Continental shelf morphology and stratigraphy offshore San Onofre, California: The interplay between rates of eustatic change and sediment supply*
  - Published in *Marine Geology*, 2015
  - Posted on SONGScommunity.com, Document Library
  - [http://www.songscommunity.com/docs/Pre-ReadNewportInglewoodandRoseCanyonFaulManuscriptcontinentalshelf.pdf](http://www.songscommunity.com/docs/Pre-ReadNewportInglewoodandRoseCanyonFaulManuscriptcontinentalshelf.pdf)

• *Segmentation and step-overs along strike-slip fault systems in the Inner California Borderlands: implications for fault architecture and basin formation*
  - Published in *Applied Geology in California: Association of Environmental and Engineering Geologists*, Special Publication Number 26, 2016
  - Posted on SONGScommunity.com, Document Library
  - [http://www.songscommunity.com/docs/Pre-ReadChapter36_Segmantation.pdf](http://www.songscommunity.com/docs/Pre-ReadChapter36_Segmantation.pdf)

• *Seismic Constraints on the Architecture of the Newport Inglewood Rose Canyon Fault: Implications for the Length and Magnitude of Future Earthquake Ruptures*
  - “In press” and pending publication in *Journal of Geophysical Research: Solid Earth*, 2016
  - Soon to be posted on SONGScommunity.com