SUMMARY
WORKING GROUP ON UTAH EARTHQUAKE PROBABILITIES
SECOND MEETING
Wednesday/Thursday, July 21 & 22, 2010
Utah Department of Natural Resources Building, Room 2000 (2nd floor)
1594 West North Temple, Salt Lake City

WELCOME AND INTRODUCTION

Bill Lund (Utah Geological Survey [UGS]) Working Group on Utah Earthquake Probabilities (WGUEP) Coordinator called the second WGUEP meeting to order at 8:00 a.m. After welcoming remarks, introductions of WGUEP members (attachment 1), and a review of the meeting's two-day agenda (attachment 2), Bill turned the meeting over to Ivan Wong (URS Corporation; WGUEP Chairperson). Ivan recapped the WGUEP process, summarized issues raised and tasks assigned at the WGUEP kickoff meeting in February, and reviewed the six-meeting schedule established to complete the WGUEP process.

Summary of Ivan's Presentation

Issues Raised Last Meeting

- Uncertainty still remains regarding segment boundaries on the Wasatch fault. Based on trench data, apparent spillover from one segment to another (e.g., 1983 Borah Peak) may have occurred on the Wasatch fault during past surface ruptures.

- This observation raises the question: "Do the Provo and Nephi segments, or portions of these segments, rupture coseismically?"

- The Brigham City segment: the early Holocene earthquake record appears to still be incomplete. This incompleteness will need to be addressed by assessing recurrence along this segment (*addressed by subsequent OxCal analysis*).

- Questions remain regarding the timing, recurrence, and extent of mid- to late-Holocene earthquakes on the Weber segment. Discussions with the original investigators who conducted the initial studies on this segment may help resolve these uncertainties (*addressed by subsequent OxCal analysis*).

- Over what time period is the paleoseismic record complete for the Nephi segment? Are the three most recent (late Holocene) earthquakes temporally clustered?

- What is the best coefficient of variation (COV) or range of COVs to be used in the time-dependent models?

- The relation of the West Valley fault zone (WVFZ) to the Salt Lake City segment (SLCS) of the Wasatch fault zone (WFZ) remains uncertain. Upcoming UGS

investigations on the SLCS and WVFZ are expected to reduce this uncertainty (*paleoseismic investigations currently underway*).

- Is the strand of the Wasatch fault located east of Salt Lake City and the East Bench fault of the SLCS at the base of the range active? (*existing mapping would indicate not active*)

- What is the best way to convert horizontal geodetic extension rates to fault dip-slip rates?

- The magnitudes of pre-instrumental earthquakes within the Wasatch Front, particularly those near Salt Lake City, need to be revisited. Current magnitude estimates rely on Modified Mercalli Intensity estimates and it may be possible to refine the magnitudes using a more current magnitude-maximum intensity model.

Tasks Identified Last Meeting

- Re-examine background seismicity recurrence with an emphasis on pre-instrumental seismicity. Note that the region we have defined for the forecast may not exactly match the region for which the recurrence has been calculated – Walter Arabasz and Jim Pechmann.

- Write up the calculation of COV for the Wasatch fault – Susan Olig.

- Perform OxCal analyses of remaining segments of the Wasatch fault – Chris DuRoss, Susan Olig, Tony Crone, Steve Personius, and Bill Lund (*done*).

- Compare geodetic extensional strain rates with geologic slip rates – Mark Peterson.

- Develop a list of Quaternary-active faults in the forecast region – Bill Lund (*done*).

- Create strawman rupture scenarios for the Wasatch fault – Chris DuRoss (*underway*).

- Complete megatrench report and distribute to other working group members – Susan Olig.

- Establish a password protected website for the working group – Steve Bowman (*done*).

WGUEP Schedule

The original six-meeting schedule presented at the kickoff meeting in February is presented below. Ivan noted that to ensure a smooth flow of data to the WGUEP process, it may be necessary to modify future meeting topics, but that the intention at this point is to maintain the six-meeting schedule.

Table 1. WGUEP meeting schedule and general scope of work.

Meeting	Purpose
1	Kickoff: Review WGCEP process and WGUEP scope of work.
2	Develop rupture scenarios for the Wasatch fault.
3	Develop time-dependent and independent recurrence rates for the Wasatch fault.
4	Develop time-independent recurrence rates for other Wasatch Front faults.
5	Review preliminary earthquake probability calculations.
6	Review and adopt final results.

TECHNICAL PRESENTATIONS

Following Ivan's presentation, the remainder of the meeting on Wednesday (July 21) and much of the meeting on Thursday (July 22) was devoted to technical presentations relevant to the WGUEP process. The PowerPoint slide shows accompanying each of the technical presentations below are available at http://geology.utah.gov/ghp/workgroups/wguep.htm.

Wednesday, July 21

- Methodology Summary - Use of OxCal and MATLAB to refine earthquake timing and recurrence for the five central Wasatch fault segments – Chris DuRoss

- OxCal earthquake timing and MATLAB recurrence interval models for the five central Wasatch fault segments (earthquake pdfs, individual intervals between events, average segment recurrence intervals, MRE timing) – Chris DuRoss, Steve Personius, Tony Crone, Susan Olig

- Summary and discussion Wasatch fault earthquake timing and recurrence intervals – Chris DuRoss

- Introduction to rupture scenario models - Bay Area faults vs. Wasatch fault - David Schwartz

- Presentation of Wasatch fault strawman rupture scenario models – Chris DuRoss

Thursday, July 22

- Presentation of Wasatch fault strawman rupture scenario models continued

- Earthquake timing and slip-rate information for Wasatch fault end segments – Mike Hylland

- Other faults in the Wasatch Front study region – how many, how big, how fast – Bill Lund (Review by working group resulted in elimination of 54 faults and identified an

additional 10 that might be eliminated upon further investigation, attachment 3)

NEW ISSUES RAISED DURING THE MEETING

New issues raised during the presentations that will need to be addressed during the course of the project include:

- Geodetic extension rates are higher than vertical (geologic) slip rates – how should the geodetic rates be weighted?

- How should recurrence intervals for the WFZ be calculated? Should only closed intervals be used, or should the elapsed time since the most recent earthquake be included as an interval?

- Are there faults other than the WFZ (e.g., the Great Salt Lake or Oquirrh fault zones) that should be modeled in a time-dependent manner?

- What is the best method(s) for calculating values of M_{max} for faults in the study region?

- What is the best method/model for moment balancing the Wasatch fault segments/other faults?

- What slip-rate values should be assigned to the Wasatch fault end segments? (those segments that do not have evidence of multiple Holocene surface ruptures)

- Ten low slip rate faults in the study area require further scrutiny to determine if they should be included in this study or excluded as contributing too little to overall earthquake probability.

TASK LIST

Following the end of technical presentations, Ivan summarized the results of the two days of meetings, and presented a list of tasks to be performed prior to the next WGUEP meeting. The tasks include:

1. Complete strawman rupture scenarios for the Wasatch fault – Chris DuRoss, Steve Personius, Tony Crone, Susan Olig, Bill Lund

2. Explore different approaches to calculate earthquake recurrence – Ivan Wong and Nico Luco

3. Compare horizontal extensional strain rates with geologic (vertical) slip-rate data for the Wasatch Front study region (What is the best way to convert horizontal geodetic extension rates to fault dip-slip rates?) – Mark Peterson

4. Determine the best approach(es) for calculating M_{max} (length, displacement, area) for study area faults – ?

5. Develop a methodology for moment balancing normal faults (create moment-balance model for the Wasatch fault) – Mark Peterson plus USGS group

6. Updates on the new SLCS and WVFZ trench data – Chris DuRoss and Mike Hylland

7. Update on Wasatch Front background earthquake recurrence rates – Walter Arabasz and Jim Pechmann

8. Evaluate "maybe" faults (10 faults in the Wasatch Front region on the bubble for inclusion in this study) – Bill Lund

NEXT MEETING

The next WGUEP meeting is scheduled for December 1-2, 2010 in Room 2000 of the Utah Department of Natural Resources Building (1594 West North Temple, Salt Lake City**,** Utah**).**

ATTACHMENT 1

Members
Working Group on Utah Earthquake Probabilities

Walter Arabasz, UUSS*
Tony Crone, USGS*
Chris DuRoss, UGS*
Nico Luco, UGS*
Bill Lund, UGS, Coordinator*
Susan Olig, URS Corporation*
James Pechmann, UUSS*
Steve Personius, USGS*
Mark Petersen, USGS*
Dave Schwartz, USGS*
Bob Smith, UUGG
Ivan Wong, URS Corporation, Chair*
Steve Bowman, UGS Liaison to WGUEP

*Attended meeting 2

ATTACHMENT 2
WORKING GROUP ON UTAH EARTHQUKE PROBABILITIES
MEETING AGENDA
Wednesday/Thursday, July 21 & 22, 2010
Utah Department of Natural Resources Building, Room 2000
1594 West North Temple, Salt Lake City

Wednesday July 21

7:30 a.m.	Continental breakfast
8:00 a.m.	Methodology Summary - Use of OxCal and MATLAB to refine earthquake timing and recurrence for the five central Wasatch fault segments – Chris DuRoss
8:30 a.m.	OxCal earthquake timing and MATLAB recurrence interval models for the five central Wasatch fault segments (earthquake pdfs, individual intervals between events, average segment recurrence intervals, MRE timing) – Chris DuRoss, Steve Personius, Tony Crone, Susan Olig
10:00 a.m.	Break
10:30 a.m.	OxCal earthquake timing and MATLAB recurrence interval models for the five central Wasatch fault segments continued
12:00 p.m.	Lunch
1:00 p.m.	Summary and discussion Wasatch fault earthquake timing and recurrence intervals – Chris DuRoss
2:00 p.m.	Introduction to rupture scenario models - Bay Area faults vs. Wasatch fault - David Schwartz
2:30 p.m.	Break
3:00 p.m.	Presentation of Wasatch fault strawman rupture scenario models – David Schwartz, Chris DuRoss
4:30	Wrap up – Ivan Wong
5:00 p.m.	Adjourn

Thursday July 22

7:00 a.m.	Continental breakfast

7:30 a.m.	Final rupture scenario model selection and weighting by working group members - moderator Chris DuRoss
9:00 a.m.	Earthquake timing and slip-rate information for Wasatch fault end segments – Mike Hylland
10:30 a.m.	Break
11:00 a.m.	Summary and discussion of Wasatch fault end segment data - select end segment parameters for probability model – Mike Hylland
12:00 p.m.	Lunch
1:00 p.m.	Other faults in the Wasatch Front study region – how many, how big, how fast – Bill Lund
2:30 p.m.	The way forward – Ivan Wong
3:00 p.m.	Adjourn

ATTACHMENT 3
Wasatch Front Study Area Faults Other than the Wasatch Fault
Requiring Additional Investigation for Inclusion in Study
or
Eliminated from Further Study Consideration

Faults Requiring Additional Evaluation

East Cache fault zone northern section
Joes Valley fault zone east fault
Joes Valley fault zone intergraben faults
Joes Valley fault zone west faults
Long Ridge Northwest side
Long Ridge West side
Ogden Valley North Fork
Ogden Valley Southwest Margin faults
Stinking Springs
Sublette Flat

Faults Eliminated from Further Study Consideration

Almy
Bald Mountain
Bear River Range faults
Blue Springs Hills faults
Cedar Mountains - East side
Cedar Valley - South side
Clover fault zone
Cricket Mountains - North end
Deseret
Dolphin Island fracture zone
Duncomb Hollow
East Kamas
East Lakeside Mountains fault zone
East Side Sublette Range faults
Elk Mountain
Frog Valley
Gooseberry graben
Hansel Mountains - East side
Hansel Valley - Valley floor
Hyrum
Japanese and Cal Valley faults
Lakeside Mountains - West side
Little Diamond Creek
Lookout Pass

Mantua area faults
North Bridger Creek
North Promontory Mountains
Ogden Valley NE Margin faults
Pavant faults
Pleasant Valley fault zone - Dry Valley graben
Pleasant Valley fault zone - graben
Pleasant Valley fault zone - unnamed faults
Puddle Valley fault zone
Raft River Mountains
Round Valley faults
Ryckman Creek
Sage Valley
Saint John Station fault zone
Saleratus Creek
Sheeprock Mountains
Simpson Mountains faults
Snow Lake graben
Southern Joes Valley fault zone
Spring Creek
Sugarville Area faults
The Pinnacle
Valley Mountains monocline
Vernon Hills fault zone
Wasatch monocline
West Pocatello Valley
Western Bear Valley faults
White Mountain Area faults
Whitney Canyon
Woodruff