

Discussion Draft

Meeting Minutes of the Subcommittee on Disaster Reduction

6 November 2008, 10:00 a.m. to 12:00 p.m., Department of the Interior, Room 7000A

Italics indicate absent members. "T" indicate members participating via teleconference.

Officers

David Applegate (USGS), Chair
Margaret Davidson (NOAA), Vice-Chair (T)
Dennis Wenger (NSF), Vice-Chair

NSTC Liaison

Jonathan Kolak (OSTP)

Designated Representatives

BLM *Edwin Roberson*

Ronald Huntsinger

CDC *Mark Keim*

DHS Bruce Davis

DHS/FEMA *Mike Buckley*

DHS/USCG *Steven Cohen*

DOD *Al Johnson*

DOE *Patricia Hoffman*

DOT Sheila Duwadi

Cheryl McQueary

Tim Schmidt

EOP / OSTP Jonathan Kolak

EDA *Audrey Clarke*

EPA *Peter Jutro*

Stephen Clark

FERC *Berne Mosley*

HUD *David Engel*

NASA *Steve Ambrose*

NGA *Stephen Homeyer*

NGB *Dave Wilmot*

NIH *Allen Dearry*

NIST William Grosshandler

Jack Hayes

NOAA Margaret Davidson (T)

NSF *Dennis Wenger*

OPHS Sven Rodenbeck (T)

State *Cari Enav*

Fernando Echavarria

USACE *Barbara J. Sotirin*

Dimitra Syriopoulou

USAID *Sezin Tokar*

USDA *Melissa Simpson*

USFS Susan Conard

USGS David Applegate

Paula Gori (T)

Other Attendees

DHS/FEMA Stephen Carruth

NASA Shahid Habib

NOAA John Gaynor

Nathalie Valette-Silver (T)

NGA Rob Meltzer

Secretariat Emily Wallace

Ross Faith

Agenda

- 10:00 Welcome and Introductions
- 10:05 Approval of October Meeting Minutes
- 10:10 Report from the Chair
- 10:45 Report from the Vice-Chairs
- 11:00 Report from the NSTC Liaison
- 11:15 Presentation: NIST Response to the World Trade Center Disaster: Federal Building & Fire Safety Investigation of the World Trade Center Disaster
- 11:45 Close and Next Actions

Handouts

- Agenda
- October Meeting Minutes
- Presentation: NIST Response to the World Trade Center Disaster: Federal Building & Fire Safety Investigation of the World Trade Center Disaster
- Guidance Request for Cascading Disasters and Disasters Roundtable Irvine Workshop

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I. Call to Order and Introductions

Subcommittee on Disaster Reduction (SDR) Chair David Applegate (USGS) called the meeting to order at 10:08 a.m.

II. Approval of October Meeting Minutes

The October Meeting Minutes were approved with no abstentions or oppositions.

III. Report from the Chair

Subcommittee Chair David Applegate (USGS) began his report by thanking all those who provided responses to the United Nations/International Strategy on Disaster Reduction (UN/ISDR) Joint Early Warning Questionnaire noting that the Subcommittee managed to solicit a good number of responses and received expert advice in answering questions in thirteen of seventeen disaster categories. Applegate noted that he will be working together with State and OSTP during the coming weeks to mold the U.S. response into a form suitable for returning it to the UN/ISDR.

Applegate also thanked those who provided clearance responses to the “Satellite Resolution Requirements for Disaster Reduction” document and advised the group that the Subcommittee is assuming concurrence if it does not hear from an agency. The SDR leadership will be working with OSTP to determine if a higher level of concurrence at the Committee on Environment and Natural Resources (CENR) is needed.

The Chair also announced that a reorganization of the SDR/USGCRP Joint Task Group on Disaster Mitigation and Climate Change Adaptation is underway and will now include the United States Group on Earth Observations (USGEO). Applegate (USGS) will circulate a revised Terms of Reference that reflects this change to Subcommittee members as soon as the document is amended.

Looking towards the transition, Applegate noted that while the Grand Challenges are the Subcommittee’s primary calling card, an effort to fashion the Grand Challenges matrices into a “virtual hip pocket guide to the U.S. government capacity to manage hazards and disasters” hosted on the password-protected SDR website is proceeding with good speed and will be ready for beta testing next month.

Shahid Habib (NASA) asked if the SDR would be assembling an official “transition document” and if Subcommittee would survive to the next administration.

Applegate largely deferred the question to Jon Kolak (OSTP) but briefly reminded members that the Grand Challenges are the Subcommittee’s primary calling card, supplemented by the online hip pocket matrices.

National Science and Technology Council (NSTC) Liaison Jon Kolak accepted the opportunity to report that OSTP is officially in transition. He stated that he did not have much light to shed on upcoming changes at OSTP, as the office is waiting for guidance from the incoming administration, but did share the possibility that some dormant committees might be reactivated or the NSTC may be restructured altogether. Kolak stated that he did not have any specific guidance about putting together a transition packet for the incoming administration, but mentioned that any one pagers to augment the Grand Challenges would be helpful. Kolak (OSTP) also expects to have more information to share at the next meeting of the Subcommittee on December 4th.

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David Applegate (USGS) stated it was his understanding that the CENR Executive Secretariats would be meeting in early December to talk about the transition and to highlight areas where there is similar messaging.

Jon Kolak (OSTP) mentioned that there are two discussions currently underway at OSTP. The first relates to the structure of OSTP, and the second to function of NSTC. Christyl Johnson (OSTP) will replace Nestor Ramirez (OSTP) as NSTC Executive Director. One of Nestor's duties had been moving the work of OSTP into the digital age; Christyl will be working to forward this initiative. As part of this effort, CENR and its subcommittees will be called upon to use the MAX portal (<https://max.omb.gov/maxportal/>). Before the December SDR meeting, the Secretariat will assemble and distribute to SDR members information and instructions on how to log onto and use the MAX portal.

Applegate and Kolak noted that the Bush administration is working hard to ensure a smooth transition.

Applegate then drew the members' attention to a request from the Disasters Roundtable, which is seeking the Subcommittee's expertise on three questions related to cascading disasters:

1. What is a cascading disaster?
2. Why is the concept of cascading disasters important?
3. What are the special challenges presented by cascading disasters, as compared to discrete disasters?

Applegate (USGS) also informed the members that the Disasters Roundtable is seeking their input on the content of the next Disaster's Roundtable Workshop, which is being held on Thursday, February 28th in Irvine, California. The Chair stated that he would share any of the member's thoughts with the Disaster's Roundtable Steering Committee. Members who would like to provide their thoughts on relevant definitions, ideas for speakers, or other related issues should send them to David Applegate or Emily Wallace (ewallace@grs-solutions.com) by December 1st.

Applegate announced that the U.S. Geological Survey is leading the Great Southern California ShakeOut, which runs from November 12th-18, 2008. On November 13th the ShakeOut Drill will commence. It will be the largest disaster awareness event ever produced and is expected to produce a rich suite of broad-based information which would be applicable to other initiatives in the disaster community. Quotes and statements generated during the event may provide excellent language to cast disaster-related science in an important light. For more information, visit the U.S. Geological Survey's one-stop website: www.usgs.gov/shakeout or the Great Southern California ShakeOut website: <http://www.shakeout.org/>.

IV. Report from the Vice-Chairs

Vice-Chair Margaret Davidson (NOAA) reported that a two-pager outlining and proposing collaboration among the Subcommittee on Disaster Reduction, the Climate Change Science Program, and the United States Group on Earth Observations will be useful and should be ready for the next meeting.

The floor was then opened to the NSTC Liaison, Jon Kolak.

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V. Report from the NSTC Liaison

Jon Kolak (OSTP) stated that OSTP and OMB have commented on the Draft Space Weather Implementation Plan, which is still in the clearance process. He was optimistic that the document would proceed to the CENR level in relatively short order. He added that having the document in hand by early December would help facilitate CENR clearance before the next administration takes office.

Regarding the “Satellite Resolution Requirements” document, Kolak reported that OSTP is assembling comments. The document should not get bogged down, since it is a straightforward request, but it may need additional levels of clearance before it can go to NOAA. In particular, OSTP has questions about the way SDR responded to question two in NOAA’s initial request.

Applegate observed that when the government has erred on the side of openness related to satellite information in the past, new capabilities have become available. He explained that this was the reasoning behind the answer to question two.

Kolak questioned how satellite information provided within 24 hours could be useful in responding to natural disasters. Bruce Davis (DHS) responded that a 24 hour data study found that such information was an important component of the emergency management response during Hurricane Katrina and offered to provide the study for Kolak’s review.

VI. Presentation: National Institute of Standards and Technology (NIST) Response to the World Trade Center Disaster: Federal Building & Fire Safety Investigation of the World Trade Center Disaster – Dr. William Grosshandler

Applegate introduced Bill Grosshandler, Chief of the Fire Research Division in the Building and Fire Research Laboratory of the National Institute of Standards and Technology (NIST). His responsibilities and technical areas of interest include fire dynamics, sensing of fires, mechanisms of fire suppression, fire retarded polymers, and advanced fire service technologies.

Bill Grosshandler thanked David Applegate and the Subcommittee for allowing him the opportunity to present to the group. He made the observation that the topic of his presentation is very much in line with the natural focus of the SDR, cuts across agency boundaries, and is particularly relevant to the Department of Homeland Security.

The investigation into the collapse of the World Trade Center Tower 2 Building (WTC 2) was finished in 2005 and was accompanied by press conferences and feedback from the technical community and the public. Although less prominent in the public’s eye, the collapse of the World Trade Center 7 Building (WTC 7) presents a more interesting case study.

Summarizing some facts of the geographic layout of the New York City World Trade Center complex and the events of September 11, 2001, Grosshandler noted that WTC 7 was not struck by an airplane, like Towers 1 and 2, and no lives were lost in its collapse. WTC 7 was located north of the main complex, standing 47 stories and built over a Con Edison power substation.

The collapse of WTC 7 marks the first known instance of such a skyscraper collapsing primarily from fire. WTC 7 was a big building, encompassing 2 million square feet of floor space. Floors 5 and 6 were mechanical spaces; floors 7-45 housed commercial tenants; the 46th and 47th floors were mainly tenant floors but were also structurally reinforced to withstand additional loads. The columns of WTC 7 did not align with the building’s foundation, and a set of column transfer trusses and girders were constructed between the 5th and 7th floors to offset this problem.

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Shahid Habib (NASA) asked if Bill Grosshandler knew the depth of the building's foundation.

Bill Grosshandler responded that it was roughly 60 feet and was not an issue in the collapse.

Grosshandler stated that the building was not symmetric from left to right and that its slabs were of varying thickness. The building also had a complex system of fuel tanks and emergency generators. The 5th floor was the location of the emergency power system components. Some tenants also had special emergency power needs, and the special emergency power delivery system of Salomon Smith Barney may have been a significant factor in the collapse.

Grosshandler noted that the investigation team needed to determine what damage was caused by the collapse of WTC 1. Through video captured on September 11th, the team was able to trace the flight of debris as it cascaded off the collapsing WTC 1 and hit WTC 7. The primary damage to WTC 7 was on the building's south face with secondary damage on west face. The falling debris caused significant structural damage to external columns on the lower southwest corner and lower south and west faces (between floors 8-14). Fires on the lower floors 7-9 and 11-13 grew and spread since they were not extinguished by either the automatic sprinkler system, which failed, or by the New York Fire Department (FDNY), which could not draw upon New York City water due to the scale and scope of the catastrophe in Lower Manhattan that day.

In reconstructing the spread of the fire, Grosshandler noted that the investigation team talked to tenants about fire hazards on their floors that may have been factors. The team assembled information on radiation and thermal load and modeled ANSYS temperature, which told them how the building's structure should have responded during the fire. The process was quite labor intensive because it required that data be transferred manually between models to avoid crashing the computer systems. The heat transfer process proved most difficult and time consuming, requiring 6 months to finish.

Shahid Habib (NASA) asked what initial condition was used to start the model.

Bill Grosshandler replied that the team used direct visual evidence from videotape.

Grosshandler focused next on the importance of Column 79 in the collapse of WTC 7. The crux of the collapse seems to be that while Column 79 did not heat up to its internal failure point, the sheer studs did, and when they failed, the girders around them were pushed off their seats, causing loss of lateral support around Column 79. This type of failure happened on close to 9 consecutive floors, essentially stripping lateral support from Column 79 over this entire vertical span. Once Column 79 began to fall, interior columns buckled in succession from east to west. The exterior columns were not able to hold the building up thereafter.

Bill Grosshandler stated that unlike the collapse of WTC 1 and 2, the problem for WTC 7 was different as temperatures were much lower (300° C vs. 600° C). The temperature of the columns resulting from the fire in WTC 7 was only hot enough to cause a loss of strength of perhaps 10 percent, which would not have been enough to cause the collapse. The failure mechanism of WTC 7 was very different, involving strain on the columns resulting from beams that expanded 6 or 7 inches in the fire, rather than a stress mechanism.

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Dr. Grosshandler defined the engineering term “progressive collapse” as an inordinate response to seemingly minor event. He stated such tall buildings should not really collapse from the loss of one column and went on to make the following points:

- Even without the initial structural damage caused by debris impact from the collapse of WTC 1, WTC 7 would have collapsed from fires having the same characteristics as those experienced on September 11, 2001.
- Early stage fires in the southwest region did not play a role in the collapse of WTC 7. Unlike the northeast region where collapse initiated.
- Collapse time of the north face of the upper 18 floors (the floors clearly visible on videotape) was similar to the computed free fall time.
- Diesel fuel fires did not play a role in the collapse of WTC 7.
- Hypothetical blast events did not play a role in the collapse of WTC 7.

Dr. Grosshandler noted the following factors that could have mitigated the collapse of WTC 7:

- More robust connections and framing systems to better resist the effects of thermal expansion on the structural system.
- Structural systems expressly designed to prevent progressive collapse. The current model building codes do not require that buildings be designed to resist progressive collapse.
- Better thermal insulation (i.e., reduced conductivity and/or increased thickness) to limit heating of structural steel and to minimize both thermal expansion and weakening effects. Insulation has been used to protect steel strength, but it could be used to maintain a lower temperature in the steel framing to limit thermal expansion.
- Automatic fire sprinkler systems with independent and reliable sources for the primary and secondary water supply.
- Improved compartmentalization in tenant areas to limit the spread of fires.
- Thermally resistant window assemblies which limit breakage, reduce air supply, and retard fire growth.

Dr. Grosshandler summarized the recommendations of NIST regarding the collapse of WTC 7. Based on its findings, NIST reiterated 12 recommendations from its Investigation of WTC Towers 1 and 2 and identified one new recommendation. NIST recommends that buildings be explicitly evaluated to ensure the adequate performance of the structural system under worst-case design fires with any active fire protection system rendered ineffective. Of particular concern are the effects of thermal expansion in buildings with one or more of the following features:

- long-span floor systems which experience significant thermal expansion and sagging effects,
- connection designs (especially shear connections) that cannot accommodate thermal effects,
- floor framing that induces asymmetric thermally-induced (i.e., net lateral) forces on girders,
- shear studs that could fail due to differential thermal expansion in composite floor systems, and
- lack of shear studs on girders.

Careful consideration should also be given to the possibility of other design features that may adversely affect the performance of the structural system under fire conditions.

Bill Grosshandler (NIST) invited questions from SDR members.

David Applegate thanked Bill Grosshandler for his presentation. Applegate drew a parallel between Dr. Grosshandler’s presentation and the earthquake-oriented Great Southern California ShakeOut next week, and indicated that there is a very large difference between 10 and 47 story buildings in terms of infrastructure.

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Bill Grosshandler concurred, stating that skyscrapers above 40 stories change fire fighting responses due to limitations of ladder height.

David Applegate asked how common hybrid water sprinkler systems, like the one found in WTC 7, are in tall buildings. He noted that the National Fire Protection Association mandates two systems, the first of which is almost always a gravity tank, and the second, a pressure system for the other floors.

Bill Grosshandler commented that the failure mode was not necessarily one of water supply but rather the pumping system, which needed more pressure.

Bill Grosshandler noted that heat transfer was the pinch point of the investigation. The NIST team pushed state of art of computing beyond where it was to get an accurate result and satisfactory explanation of WTC 7's collapse. He noted that huge improvements in terms of interoperability will result from this work.

Close and Next Actions

David Applegate stated that the next SDR meeting will be held December 4th, 2008 and will include a presentation from Paul Lewis (NGA).

VII. Adjournment

The meeting adjourned at 11:41 a.m.

VIII. Future Meetings

The SDR meets on the first or second Thursday of every month from 10 a.m. to 12 p.m. unless otherwise noted.

December 4, 2008	May 7, 2009	October 1, 2009
January 8, 2009	June 4, 2009	November 5, 2009
February 5, 2009	July 2, 2009	December 3, 2009
March 5, 2009	August 6, 2009	
April 2, 2009	September 3, 2009	

XII. Agenda Items and Other Communications with the Subcommittee

Please send proposed agenda items and any other items intended for distribution to the full Subcommittee to Emily Wallace (ewallace@grs-solutions.com).

XIII. Contact Information SDR Leadership

David Applegate, Chair, 703-648-6714, applegate@usgs.gov
Margaret Davidson, Vice Chair, 843-740-1220, Margaret.davidson@noaa.gov
Dennis Wenger, Vice Chair, (703) 292-8606, dwenger@nsf.gov

Secretariat

Emily Wallace, 703-560-7448, ewallace@grs-solutions.com

XIV. Summary of May Actions

Action	Lead	By When
SDR financial support: Contact Dave (applegate@usgs.gov) if you would like a personalized support request letter to your	SDR Members	Standing

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agency.		
Contact Emily (ewallace@grs-solutions.com) to receive copies of the Grand Challenges for Disaster Reduction Implementation Plan packets or CD.	SDR Members	Standing
Let Emily or Dave know how you use the implementation plans, including when you link to the plans from your agency websites.	SDR Members	Standing
Send Emily or Dave additional distribution suggestions, including relevant contact information.	SDR Members	Standing
Let Emily know if you are interested in funding the National Research Council Study on Measuring Community Resiliency.	SDR Members	ASAP
Provide 24 hour data study to Jon Kolak and Secretariat	Bruce Davis	Complete
Send comments on cascading disasters and Disaster's Roundtable Irvine Workshop to Emily (ewallace@grs-solutions.com).	SDR Members	December 1, 2008
Upload SDR documents onto OMB MAX Portal	Secretariat	December 3, 2008
Send email to members explaining how to access OMB MAX Portal	Secretariat	December 3, 2008
Develop two-pager outlining collaboration among SDR/CCSP/USGEO.	Secretariat	December 3, 2008