

**Meeting of the National Construction Safety Team Advisory Committee  
December 14, 2006**

**Minutes**

**Committee Members**

Paul Fitzgerald, Chair  
John Barsom  
Robert Hanson  
Forman Williams  
David Collins (did not attend)  
Kathleen Tierney (did not attend)  
Charles Thornton (did not attend)

**Welcome and Introduction**

Mr. Fitzgerald called the meeting to order at 9:00 am. Four members of the NCST Advisory Committee (Fitzgerald, Barsom, Hanson and Williams) were present on the call, which constituted a quorum. He reminded the Committee that it was an open session and that the meeting was being audio web cast to the general public. He also noted that two individuals had requested the opportunity to speak to the Committee and that those individuals would call in at 10:30 a.m. to address the Committee. Mr. Fitzgerald pointed out that the public comment period speakers would be limited to 5 minutes each as had been the case in previous meetings of the committee. He told the speakers registered for the public comment period that their comments should be limited to the issue of what they believe the NCST Advisory Committee should be reporting to Congress in its 2006 report and to the status of the World Trade Center 7 investigation.

**James Hill, Acting Deputy Director, NIST**

Dr. Hill thanked the members of the Advisory Committee for being present for the meeting and welcomed them on behalf of Dr. William Jeffrey, NIST Director. Dr. Jeffrey was unable to be present due to travel commitments. Dr. Hill offered to answer any questions that the Advisory Committee might have for him or for the NIST Director and noted that Dr. Sunder would be updating the Advisory Committee on the status of the Investigation of the collapse of World Trade Center 7 (WTC 7).

Dr. Hill noted that NIST is currently in the FY07 and 08 budgeting process. The current outlook is that NIST will be operating under a continuing resolution for an extended period of time, possibly through the end of the fiscal year. The current budget situation will not affect the ongoing investigation of WTC 7 or the Advisory Committee operation.

**Shyam Sunder, Acting Director, Building and Fire Research Laboratory and WTC Lead Investigator**

Since the release of the Final WTC Towers Reports in October 2005, NIST has worked vigorously with the standards and codes organizations, including the International Code Council (ICC) process and the National Fire Protection Association (NFPA) process, as well as the group of building code experts that is working under a NIST contract to the National Institute of Building Sciences (NIBS) to formulate code change proposals. A large number of code change proposals were submitted by the March 24, 2006 deadline for the International Building Code and the initial hearings were held in September 2006. This was the initial round of hearings where all stakeholders, including the private sector are able to weigh in on code change proposals. The outcome of the code hearings was better than expected. The initial expectation was that most of the code change proposals would not be approved; however three of the proposals that deal with fireproofing requirements were approved. These proposals addressed bond strength, quality control, and application of spray-applied fire resistive materials. Also, a proposal for installation of firefighter elevators was approved by the assembly.

In addition, the industry came forward strongly to say that they are going to develop an alternative proposal for progressive collapse. There is a very robust industry group, led by the National Council of Structural Engineering Associations (NCSEA). This group is developing a consensus-based alternative proposal and they have promised to put forward an alternative proposal by August 2007, the deadline for submitting proposals for the next code cycle.

There are several other changes that are not only working through the ICC and NFPA processes but also through the standards processes of organizations such as the American Society of Mechanical Engineers (ASME), the American Society of Civil Engineers (ASCE), the American Society for Testing of Materials (ASTM), and a range of other organizations. NIST is committed to working with those organizations, and will continue to do that over the next few years.

NIST staff have also been working on analyzing the collapse of WTC 7. NIST has taken a number steps and made good progress. NIST re-evaluated their initial approach used for this analysis and developed an updated approach that is much more robust. As a result of this re-evaluation, NIST re-competed the contracts and has a good group of contractors working with the NIST team to conduct this work.

**Therese McAllister, Project 6 Co-Leader**

Dr. McAllister briefed the committee on the progress that has been made on analyzing why and how the 47-story WTC 7 building collapsed at 5:20 pm on September 11, 2001.

[\(Presentation: "WTC 7 Technical Approach and Status Summary", December 12, 2006, Therese McAllister, NIST\)](#)

Dr. Sunder noted that the end product of the WTC 7 investigation will be three reports. One will be a companion to the original summary report for the towers (NCSTAR 1). It will be written in a narrative format so that it is accessible to a large audience. The second will be a detailed technical report, written by NIST staff, along the lines of the previous technical reports, with all of the details and assumptions used in the analysis. The report will cover all aspects of the investigation of WTC 7. Appendices will include the seismic analysis and the review of the Consolidated Edison Substation, preliminary structural response analysis, and the hypothetical blast scenarios. The third report will be written by ARA on the modeling work they and their subcontractors have performed in support of the investigation.

Q: What is going to be the final result of the analyses and how well are we going to be able to defend it?

A: The state of our analysis at this point is at the same state as where we were with the towers in early 2004, at which point we were not even in a position to speculate as to whether or not we would have a probable collapse sequence. We are going to bring the best science we can to the problem and try to consider “what-if” scenarios. Obviously, there might be the leading hypothesis, but we will also try to ask the “devils advocate” question as to whether this is a unique solution or one of many that could have given us the same answer. At this point it is fair to say that we are not in a position to give an assessment of where we might end up in a few months from now.

C: Maybe the first step is to make a list of what we really know as fact and then what are the assumptions that are being made above and beyond those facts.

A: We have tried to analyze the interviews to generate a timeline of events and we are going to do the same thing with the photographs and with any other hard evidence that we have. It is an excellent suggestion for us to move forward.

Q: Will you, like you did for the Towers, put some range of likelihood on the assumptions so that you can do a variance in terms of the analysis?

A: In the case of the Towers, we used a statistical process to understand uncertainty in variables and when we get to a point where we believe that we are close enough we will try and do that. We will certainly try to quantify uncertainty if we are able to do it in a rigorous fashion.

Q: In your blast analysis, at what time of day did these blasts occur?

A: Part of what we are evaluating is what could take place, within the realm of designing a method to remove these columns, considering the time available and when it would have to occur.

A: We are doing the blast analysis primarily for completeness. As we have said, we have not seen any evidence of controlled demolition or a blast event. As you know we put out a fact sheet just a few months ago with regard to the towers where we state that any blast material would have to be pre-positioned and triggered to synchronize with the collapse of the building. We want to try and see if a hypothetical event, even if such improbable events were synchronized to take place, could be discriminated from the other more normal events that we think are the primary reasons why the building collapsed.

Q: On slide 13, both of the Damage States have damage above Floor 7 and also on Floors 5 and 6. Am I reading the slide correctly? Did I misinterpret what you said?

A: The table on slide 13, shows possible different scenarios. For example, for Damage State 1, one possible scenario would be that the initiating event was caused by fires only on Floors 7-13. Another possible scenario would be that fires on Floors 5 and 6, as well as 7-13, caused the initiating event. There are six possible scenarios for each Damage State because the fireproofing condition is imposed on each of the damage scenarios. Since the condition of the fireproofing was not directly observed, we are considering a range of fireproofing conditions to understand the role the fireproofing condition plays. So, there are a total of 12 scenarios when Damage States 1 and 2 are considered.

Q: Was it necessary to re-initialize the FDS analysis to account for fires observed from outside on different floors?

A: Once the fire is started in FDS, it keeps going. If we reached a point where the fire was behaving differently than the visual evidence, then we would have to take a look at restarting or stopping the fire in that location to be consistent. Obviously, the evidence is what counts; the simulation has to follow it.

We are also doing sensitivity analyses to find, within the reasonable range of the variables, if there could be things accounting for the visibility or non-visibility of the fire. For instance, on some of the floors there are large numbers of interior partitions between the core of the building and the exterior face. We need to know how long a fire could be hidden on the inside of a series of those partitions before you would see it break through and show up on the outside. As we did with the Towers, we varied the fuel load to make sure that the progress rate of the fires was consistent. We are pinning all of the simulations to those pieces of evidence that we have, such as when were the windows broken, where were they broken and so on.

Q: In the best case run, how many times did you have to stop and restart the FDS analysis?

A: Not more than once per run.

Q: In one of your slides, you used the phrase “large-span floor bay.” I assume this refers to the portion of the building that was over the ConEd substation. Have you been able to

determine how the rest of the building might have been tied into this portion of the building over the substation and what the connecting strength for lack of a better term, might have been with some of those ties?

A: The large-span floor bay referred to areas where there were fifty-foot spans between the edge of the core and the exterior of the building, primarily along the north face and the east face. The core was not centered in the building so that the south and west faces had shorter spans.

Q: In 2004 you were still investigating how the critical columns that supported this large span area were tied back to the rest of the building and you were trying to get more structural drawings. If my notes from our 2004 meeting are accurate, you were looking to see what the ties were, the strength of those ties, and how they might have initiated a pull.

A: In the structural model at that time we wanted to get better information on how the connections were designed in this building. NIST has reviewed the structural drawings; however these drawings do not include the connection details. We do have access to most of the other information on the structural members. To develop the information on the details of the connections, we have talked to the company that originally was the structural engineering firm for the building. We have also talked to structural engineers of the era who know the practice in New York City and were in a position to tell us the kind of detailing that would have been used in a building in the mid-1980s. With regard to the initiating event and the tie-back of the column to the rest of the structure, we have a good model of that now. Exercising the model and working on the what-ifs are being done at the present time.

Q: You indicated in June that you had reviewed the seismic information, and you mentioned specifically what the impact might have been on the fireproofing in the building itself. Have you done any analysis as to what the damage might have been to piping, specifically the fittings of the piping that were used in providing fuel to these emergency generators that apparently were located through the building and in addition the piping that came in from the tanks that were located outside?

A: The main focus of the review of the seismic data was to establish the timing of the various events and to see if there were any events that we could not explain other than the collapse of the Towers and World Trade Center 7. The signal strengths due to the collapse of the Towers were not of a magnitude that was seismically significant from an earthquake design standpoint or from the design or failure of a structural component or a piping system that might be used in a structure. There was nothing in the data that suggested a significant seismic event that could have ruptured the pipeline.

Q: Is a pipeline rupture one of the scenarios that you are going to be looking at?

A: For each damage state there is one case where we have fire on Floors 5-6 plus floors 7-13. The 5<sup>th</sup> floor fire, as far as we know, was not a normal building contents fire and

our hypothesis is that it was a fire caused by the pressurized fuel line there. We also see a tremendous amount of fire on Floors 7-13, which are normal building fires. As we saw in the Towers and as we have seen in the large-scale tests such as the Cardington tests, floor sagging is a significant event and there is impact or distress at the connections and crimping at the tops of columns. These are all possibilities that we are exploring due to the fires that were present between floors 7-13.

Q: Are you able to ascertain to what standard, if any, the combustible liquid piping was built?

A: We did have a contractor review the fuel systems in WTC 7 and a report on this review (NCSTAR 1-1J) was released along with the initial Towers report. The review included a look at standard practices. The indication was that the piping was installed according to standard practice. The pressurized line was unusual, but there was no code requirement against such a design. If the pressurized line were to break a certain way at a certain time, the normal safety features in fuel systems may not have operated appropriately and therefore there was the possibility of building up a substantial pool of liquid or a spray that would have led to an intense fire.

The scope of the ConEd study was to understand the layout and the types of equipment located in the building, what observations were made by the people who were in the substation, and if there was any information generated from that building that might be useful to the investigation. We were not looking at the structural details of the ConEd building, but we are dealing with the tie-back and the transfer trusses in other sections of our reports. In the ConEd study, which will be an appendix to the main report, we tried to identify any sequence of events that contributed to the outcome, but there was nothing that suggested new leads that we might want to follow. So it is therefore background and is there to eliminate some other possibilities that may have occurred.

Q: In the 80 boxes of material about the Solomon Smith Barney renovation, which came from SOM was there information that indicated that the occupancy was atypical to the occupancy in the towers, such as for a typical work station arrangement that you see in the financial centers almost everywhere?

A: No there was nothing unusual. The Solomon Smith Barney occupancy was on the upper floors. Because of the way the building collapsed, our focus is on the lower floors where the impact of the fires on the structure would be most likely to contribute to the collapse. We do have, as a result of communications with the occupants of the floors up through floor 13, a moderate amount of information about the types of furnishings, density, etc.

Q: I do not see the need to conduct the blast analysis, based on the lack of evidence, and also based on the information that you have been able to gather regarding what may or may not have been stored in certain offices in the building. On December 6 you developed the hypothetical blast scenarios for the analysis of overpressures. Are you comfortable at this point in time telling us what those scenarios might be?

A We are not far enough along in the analysis to discuss the scenarios.

### **Discussion of the NCST Advisory Committee Report to Congress**

Mr. Fitzgerald prepared a draft letter report to Congress which was circulated to the Committee members prior to the meeting in order to frame the discussion. Mr. Fitzgerald recommended the letter report format, rather than the more detailed reports submitted previously, since there had been no new investigations and little activity on the part of the Committee. The Committee members expressed agreement on the format and content of the draft report. Following discussion of a number of editorial changes, the Committee voted to accept the report to Congress with the editorial changes discussed. Mr. Fitzgerald took the action to make the editorial changes and to provide the Committee members with a final version for their review before submitting the report for transmittal to Congress.

### **Public Comment Period**

Mr. Arthur Scheuerman  
([Written comments submitted by Mr. Scheuerman](#))

Mr. Jerry Leaphart  
([Written comments submitted by Mr. Leaphart](#))

The meeting was adjourned at 10:45 am.