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Questions and Answers about the Overall NIST WTC Investigation

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1. What were the goals of the National Institute of Standards and Technology (NIST) investigation of the World Trade Center (WTC) disaster?

The goals were to investigate the building construction, the materials used, and the technical conditions that contributed to the outcome of the WTC disaster on Sept. 11, 2001. The investigation served as the basis for:

- improvements in the way buildings are designed, constructed, maintained, and used;
- improved tools and guidance for industry and safety officials;
- recommendations for revising existing building and fire codes, standards, and practices; and
- improved public safety.

2. What were the main objectives of the investigation?

The specific objectives of the NIST WTC investigation were to:

- determine why and how WTC 1 and WTC 2 collapsed following the initial impacts of the aircraft, and why and how WTC 7 collapsed;
- determine why the injuries and fatalities were so high or low depending on location, including all technical aspects of fire protection, occupant behavior, evacuation, and emergency response;
- determine what procedures and practices were used in the design, construction, operation, and maintenance of WTC 1, WTC 2, and WTC 7; and
- identify, as specifically as possible, areas in current building and fire codes, standards, and practices that warrant revision.

3. Why did NIST conduct this investigation?

NIST scientists and engineers are world-renowned experts in analyzing a building's failure and determining the most probable technical cause. Since NIST is not a regulatory agency and does not issue building standards or codes, it is viewed as a neutral, "third party" investigator.

Under the National Construction Safety Team (NCST) Act, NIST investigations are conducted to establish the likely technical causes of the building failure and evaluate the technical aspects of evacuation and emergency response procedures in the wake of such failures. The goal is to recommend improvements to the way in which buildings are designed, constructed, maintained, and used.

4. When did the investigation begin and when was it completed?

The investigation was officially announced on Aug. 21, 2002. When the NCST Act was passed in October of that year, it required that the WTC investigation be conducted under its authorities. The final report on the collapses of WTC 1 and WTC 2 was issued on Oct. 26, 2005. The final report on the collapse of WTC 7 was issued on Nov. 8, 2008, officially ending the NIST investigation.

5. Why did it take six years to complete the WTC investigation when the original plan called for the work to be done in two?

Early in the investigation, a decision was made to complete studies of the two tower collapses (WTC 1 and WTC 2) before fully proceeding on the WTC 7 investigation. The portion of the investigation dealing just with the towers ended with the release of final report in October 2005, a little more than three years from the start and comparable to the length of a typical

investigation of an aircraft crash. The time between the release of the WTC towers report and the issuance of the final WTC 7 report in November 2008 also was approximately three years.

6. In addition to the investigation into the collapses of the WTC buildings, did NIST conduct related research or programs?

The investigation of the collapses was part of a broader NIST response plan to the WTC disaster. In addition to the investigation, NIST also concurrently conducted two related programs:

- a research and development program that provided the technical basis for improved building and fire codes, standards and practices; and
- an industry-led dissemination and technical assistance program that provided practical guidance and tools to better prepare facility owners, contractors, designers, and emergency personnel to respond to future disasters.

7. Have the results of the investigation led to reforms in building and fire safety codes, standards, and practices?

NIST research typically provides the technical basis for new and improved standards, codes and practices. NIST actively works with organizations and bodies designed to make appropriate changes to ensure that results from the research are put to use. Based on the recommendations from this investigation, two sets of major and far-reaching changes have been adopted by the International Code Council (ICC) into its model building and fire codes known as the I-Codes (specifically the International Building Code, or IBC, and the International Fire Code, or IFC). Model codes are typically adopted by state and local authorities.

These 40 code changes were adopted less than five years from the release of the final report on WTC 1 and WTC 2, and less than two years following the release of the final report on WTC 7. This is an extraordinarily rapid pace in the code making and approval process.

The code changes addressed areas such as:

- increasing structural resistance to building collapse from fire and other incidents; requiring a third exit stairway for tall buildings;
- increasing the width of all stairways by 50 percent in new high-rises;
- strengthening criteria for the bonding, proper installation and inspection of sprayed fire-resistive materials (commonly known as “fireproofing”);
- improving the reliability of active fire protection systems (i.e., automatic sprinklers);
- requiring a new class of robust elevators for access by emergency responders in lieu of an additional stairway;
- making exit path markings more prevalent and more visible; and
- ensuring effective coverage throughout a building for emergency responder radio communications.

In addition to the code changes adopted by the ICC, 15 changes have been made to key National Fire Protection Association (NFPA) fire standards based on the NIST WTC investigation recommendations.

8. Will the results of the investigation help prevent future disasters?

The NIST investigation has been valuable in establishing the probable technical causes of the collapses of WTC 1 and WTC. It replaced speculative observations with objective and fact-based findings; derived instructive information from the disaster; and identified needed improvements to building and fire standards, codes, and practices and to the safety of tall buildings nationwide. Implementation of the results of this investigation will help restore public confidence by making tall buildings safer nationwide, enhance the effectiveness and safety of fire and emergency responders, and better protect building occupants and property in the future.

9. How was the investigation funded?

The agency received $16 million for the investigation in September 2002 from the federal government’s fiscal year 2002 supplemental appropriation.

10. Did NIST consult with outside experts during the investigation?

NIST marshaled world-class technical expertise from both within and outside the agency. External experts were drawn from academia, practice, and government, and used on an

as-needed basis in various phases of the investigation.

11. Did the investigation include an examination of the "human" element?

In the investigation of WTC 1 and WTC 2, NIST studied the disaster holistically, paying particular attention to the interplay among the building, the occupants, and the emergency responders. To determine the behavior and fate of occupants and responders—both those who survived and those who did not—NIST collected and analyzed information on occupant behavior, human factors, egress, and emergency communications in WTC 1 and WTC 2, to evaluate the performance of the evacuation system on Sept. 11, 2001.

The data were analyzed to study the movement of people during the evacuations, decision-making and situation awareness, and issues concerning persons with disabilities.

No one was in WTC 7 when it collapsed, so that investigation did not include a "human" element.

12. How did the NIST investigation findings correlate with those put forth by the Building Performance Assessment Team (BPAT) in its May 2002 report on the WTC disaster?

The BPAT, sponsored by the Federal Emergency Management Agency (FEMA) and the Structural Engineering Institute of the American Society of Civil Engineers (SEI/ASCE) was designed to study the events of Sept. 11, 2001, at the WTC complex, provide preliminary assessments, and serve as the foundation for a more extensive technical and scientific investigation. Or as the BPAT report executive summary states: "to present recommendations for more detailed engineering studies to complete the assessments and produce improved guidance and tools for building design and performance evaluation."

The NIST WTC investigation addressed all of the major recommendations contained in the report issued by the BPAT. The NIST plan also identified other critical issues that needed study, especially in areas that impact life safety and engineering practice.

13. How did NIST keep the public informed throughout the WTC investigation?

Over the course of its WTC investigation, NIST maintained an ongoing liaison with the professional community, the media, Congress and the Executive Branch, New York City authorities, and the public through briefings, presentations, and opportunity for comment on key investigation reports. During the period 2002-2008, there were 11 media and public briefings, including seven in New York City; 27 news releases, announcements and media updates issued; and more than 2,000 media inquiries handled. NIST also assigned a special liaison to interact with the families of those who died as well as other building occupants and first responders.

A website dedicated to the WTC investigation was established at http://wtc.nist.gov and maintained throughout the effort. The site includes a wide range of material such as NIST reports, answers to frequently asked questions, news releases, computer-based animations, conference proceedings, and NIST recommendations for strengthening building codes. Now archival, the material that resided on that website is now part of a more extensive online site for NIST's Disaster and Failures Studies Program and is accessible at the same URL as before. The final reports on the WTC towers and WTC 7 are available in their entirety, along with thousands of photos and videos received from the public, and additional documents collected throughout NIST's research effort.

14. Can NIST's findings be used in court?

No part of any report resulting from NIST investigations conducted under the authorities of the NCST Act can be admitted as evidence or used in any suit or action for damages. Additionally, NIST employees involved with these investigations are not permitted to serve as expert witnesses.

15. Has NIST responded to those who believe that the WTC towers and WTC 7 collapsed in ways other than the mechanisms determined by the NIST investigation?

When the WTC investigation was completed in 2008, many in the building design, construction, fire, rescue, safety, and legislative communities praised the effort as the authoritative accounting of the events that took place on 9/11. With the support and collaboration of these groups, 40 code changes based on the recommendations from the WTC investigation have been adopted into the model building and fire codes. This is a solid affirmation that the work done by the NIST WTC investigation team was of the highest quality and critical to ensuring that future buildings—especially tall structures—will be increasingly resistant to fire, more easily evacuated in emergencies, more accessible to first responders when needed, and most importantly, safer overall. However, there have been claims from alternative theory groups that factors other than

those described in the NIST reports brought the WTC towers and WTC 7 down.

To respond to a number of the questions raised about the collapses of the WTC towers, NIST posted a fact sheet in 2006 stating that NIST found no corroborating evidence for alternative hypotheses suggesting that the buildings were brought down by controlled demolition using explosives or by missiles. In 2007 and 2008, additional fact sheets addressed later questions from the alternative theory groups, including questions related to the collapse of WTC 7.

The information from these fact sheets has been consolidated into the current FAQs on the WTC towers and WTC 7.

NIST respects the right of others to hold opinions that do not agree with the findings and conclusions described in its reports on the collapses of WTC 1, 2 and 7. However, the WTC investigation team stands solidly behind these findings and conclusions, including the failure mechanisms defined for each building and the sequences of events leading to the initiation of the three collapses.