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R E P O R T



Considering the Effects of a Catastrophic Terrorist Attack

Charles Meade, Roger C. Molander



CENTER FOR TERRORISM RISK MANAGEMENT POLICY

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Preface

In 2004, the RAND Corporation performed a study for the Department of Homeland Security to examine response strategies following a catastrophic terrorist attack. For this work, a detailed scenario was constructed, describing the effects of a terrorist-detonated nuclear explosion in the Port of Long Beach, and a series of strategic decisionmaking games were executed with leaders from the government and the emergency response community.

First, the research elucidated a number of important gaps in the capability to respond to a large-scale terrorist event. Second, it also suggested that the effects could extend far beyond the time and location of the initial attack as society and the business community struggled to absorb the large-scale aftereffects.

To investigate these phenomena, we extended the initial study to examine the response to a catastrophic terrorist attack, focusing on policies and timescales beyond the concern of the initial emergency response. For this phase of the research, we made slight modifications to the original attack scenario and we redesigned the strategic decisionmaking games.

This technical report should be of interest to federal, state, local, and private-sector officials responsible for estimating terrorism risks and providing guidance on resource allocation and prioritization based on these risk estimates.

This study results from the RAND Corporation's continuing program of self-initiated research. Support for such research is provided, in part, by donors and by the independent research and development provisions of RAND's contracts for the operation of its U.S. Department of Defense federally funded research and development centers.

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Summary

A quickly growing concern about terrorism is that a devastating attack would send social and economic aftershocks cascading through multiple sectors long after the initial strike was over. While much analysis has been done on the possible short-term effects of an attack of this magnitude, no work has investigated longer-term implications. Exploratory efforts to do so are needed.

With this motivation, the RAND team developed a novel approach that enabled us to investigate two key policy questions:

- *Within the first 72 hours, what would the direct effects of such an attack be? What human casualties, property damage, and destruction of infrastructure would result immediately?*
- *In the weeks and months after the attack, what would the longer-term economic implications be? From a decisionmaking standpoint, what would the particularly challenging policy issues be? What would the high-priority concerns for different stakeholder groups be?*

To answer the first question, we conducted a scenario analysis; strategic gaming provided us with insights into the second. Both tools provide means of exploring highly uncertain policy landscapes. In scenario analysis, researchers posit a “what if” framework and examine how various factors might interact to generate a sequence of events—i.e., “What if such and such happened next?” In strategic gaming, participants are realistically immersed in a stressful event and directed to explore the resulting policy challenges for various stakeholders. By combining these approaches, we were able to link the immediate challenges of a hypothetical attack with its possible consequences at a macro level.

A Devastating Attack on a Key Component of the U.S. Economic Infrastructure

In our scenario, terrorists conceal a 10-kiloton nuclear bomb in a shipping container and ship it to the Port of Long Beach. Unloaded onto a pier, it explodes shortly thereafter. This is referred to as a “ground-burst” as opposed to an “airburst” explosion. We used this scenario because analysts consider it feasible, it is highly likely to have a catastrophic effect, and the target is both a key part of the U.S. economic infrastructure and a critical global shipping center.

This scenario formed the basis for strategic games with leaders from government, business, and the insurance and real estate industries. Participants shared their perspectives on what the attack's longer-term consequences might be and outlined the decisions they would be likely to make in response to the sequence of events our scenario analysis suggested. They also anticipated the decisionmaking challenges that might arise and reflected on strategies that might address these problems.

Both Short- and Long-Term Repercussions of the Attack Could Be Overwhelming

Within the first 72 hours, the attack would devastate a vast portion of the Los Angeles metropolitan area. Because ground-burst explosions generate particularly large amounts of highly radioactive debris, fallout from the blast would cause much of the destruction. In some of the most dramatic possible outcomes:

- Sixty thousand people might die instantly from the blast itself or quickly thereafter from radiation poisoning.
- One-hundred-fifty thousand more might be exposed to hazardous levels of radioactive water and sediment from the port, requiring emergency medical treatment.
- The blast and subsequent fires might completely destroy the entire infrastructure and all ships in the Port of Long Beach and the adjoining Port of Los Angeles.
- Six million people might try to evacuate the Los Angeles region.
- Two to three million people might need relocation because fallout will have contaminated a 500-km² area.
- Gasoline supplies might run critically short across the entire region because of the loss of Long Beach's refineries—responsible for one-third of the gas west of the Rockies.

Economic Implications in the Weeks and Months After the Attack

The early costs of the Long Beach scenario could exceed \$1 trillion, driven by outlay for medical care, insurance claims, workers' compensation, evacuation, and construction. The \$50 billion to \$100 billion for 9/11 puts this figure into perspective. In general, consequences would far outstrip the resources available to cope with them.

In addition, over time, the economic effects of the catastrophe are likely to spread far beyond the initial attack, reaching a national and even international scale. Decisionmakers would face two particularly difficult challenges: keeping the global shipping supply chain operating and restoring orderly economic relationships.

Keeping the Global Shipping Supply Chain Operating

In the aftermath of the attack, different stakeholder groups affected might have differing interests. Consequently, their decisions might often be at odds. How to contend with such conflicting interests is the key challenge for policymakers. In terms of global shipping, the main tension might be between the political aim of preventing a future attack and the business interest in seeing that U.S. ports and the global shipping supply chain continue to operate. The only way to completely mitigate the risk of a second strike would be to close all U.S. ports and suspend all imports indefinitely. This would be the national security community's likely position. Yet in business terms, this position would be untenable. The loss of the ports of Long Beach and Los Angeles alone, which handle 30 percent of U.S. shipping imports, would already be substantial. All U.S. ports combined carry out 7.5 percent of world trade activity. Accordingly, the business community would likely call for ports to stay open, or to reopen as early as possible.

But harsh realities facing the financial and real estate communities might prove a barrier. The Long Beach attack might cripple an insurance industry struggling to absorb massive losses from claims. Insurance would be in tremendously short supply—particularly for terrorist and nuclear risks. Without it, ports and related infrastructure could not operate. Further complicating the issue is the high probability that people would flee port cities, severely depleting local labor supplies. Given these conditions, all U.S. ports would likely close indefinitely or operate at a substantially reduced level following the attack. This would severely disrupt the availability of basic goods and petroleum throughout the country.

Restoring Orderly Economic Relationships

The attack is likely to have dramatic economic consequences well beyond the Los Angeles area:

- Many loans and mortgages in Southern California might default.
- Some of the nation's largest insurance companies might go bankrupt.
- Investors in some of the largest financial markets might be unable to meet contract obligations for futures and derivatives.

While exact outcomes are difficult to predict, these hypothetical consequences suggest alarming vulnerabilities. Restoring normalcy to economic relations would be daunting, as would meeting the sweeping demands to compensate all of the losses.

Next Steps Would Involve Further Modeling and Gaming

The analysis tools we developed for this study lay the groundwork for research exploring both the short- and long-term effects of catastrophic events. The need is pressing to continue such investigations, particularly of longer-term economic repercussions. This work would entail developing scenarios for a new generation of strategic games. The overarching goals would be to gain further insights into the policy and economic decisions likely to be made in the months

following attacks of this magnitude and characterize the decision landscape. For example, we could illuminate any potentially unprecedented behavior that might occur in the global economy in times of extreme duress, identify where existing systems are likely to fail, and evaluate the benefits of a range of potential economic policies. In this way, policymakers could start to anticipate the types of decisions they might be called upon to make, reflect in times of relative calm on their options, and plan well in advance for contingencies.

Considering the Effects of a Catastrophic Terrorist Attack

Introduction

In recent years, there has been a growing concern that targeted acts of terrorism, focused on critical economic infrastructure, could produce cascading social and economic effects over very wide scales.¹ This sentiment is reflected in the Introduction to the *Comment Draft National Infrastructure Protection Plan, Base Plan*, prepared for the U.S. Department of Homeland Security (March 2006, p. 1):

Attacks on CI/KR [critical infrastructure and key resources] could significantly disrupt the functioning of government and business alike and produce cascading effects far beyond the targeted sector and physical location of the incident.

Detailed investigations on this topic have been limited by the extreme complexity of the human and economic systems involved and the lack of data from historical experience. In this environment, there is a role for exploratory efforts to characterize the consequences of infrastructure attacks and to assess the mechanisms that might lead to cascading effects.

For this task, we carried out a scenario analysis and broad program of strategic gaming revolving around a catastrophic terrorist attack on the Port of Long Beach. We describe the results from this investigation in this technical report and provide many of the primary results from the analysis in the appendixes. The attack involves a hypothetical 10-kiloton nuclear explosion in a shipping container placed on the pier in the port.² There are a number of motivations for this particular approach. First, much has been written about the potential for nuclear terrorism, focusing on the supplies of weapons and nuclear material that might be available to our adversaries.³ Russia has played a central role in this analysis, given the large number of weapons it possessed at the height of the Cold War and the lack of controls that followed with the breakup of the Soviet Union. However, new potential sources have arisen in recent

¹ For example, see Peter Chalk, Bruce Hoffman, Anna-Britt Kasupski, and Robert T. Reville, *Trends in Terrorism: Threats to the United States and the Future of the Terrorism Risk Insurance Act*, Santa Monica, Calif.: RAND Corporation, MG-393-CTRMP, 2005.

² By comparison, the yields of the nuclear weapons in Hiroshima and Nagasaki were 12.5 and 22 kilotons, respectively.

³ Graham Allison, *Nuclear Terrorism: The Ultimate Preventable Catastrophe*, New York: Henry Holt and Company, 2004.

years with the rise of North Korea's nuclear ambitions and the revelations of the A. Q. Khan network in Pakistan.

In this environment, there has been a growing effort to limit the opportunities for terrorists to smuggle a nuclear weapon into the United States. Specifically, new initiatives to improve the security of the container shipping network have been proposed, but the challenges are large. Each day, 20,000 shipping containers from ports all over the world are unloaded in the United States. Given that there are 361 operational seaports in the country, it will be difficult to implement comprehensive in-port security programs. This vulnerability is partially offset by the Container Security Initiative that has placed U.S. inspectors in foreign ports to screen and validate the contents of containers shipping to the United States. Currently this program covers approximately 50 percent of the traffic in the largest ports, but its effectiveness against smuggling has not been tested, and there still are large volumes of containers that enter the country without any screening or inspection⁴.

To address these problems, there has been great interest in new detectors that might be able to provide warning of a device embedded in a container, ideally while a ship is still at sea. Unfortunately, recent technical reviews indicate that this type of technology is still in its infancy and that we have very little capability to reliably detect hidden weapons before they reach our shores.⁵

In summary, we chose to analyze a terrorist nuclear explosion in a shipping port because it seems quite plausible, although the actual probability of such an event is impossible to calculate. We chose a 10-kiloton explosion because it is possible to obtain such a yield with a relatively crude unboosted design.⁶

Approach

With this background, we used scenario analysis techniques to explore the range of possible consequences from a terrorist nuclear attack. Developed over many years of research at RAND, scenario analyses examine the interactions between various factors in a sequence of events in a "what if" framework. Although scenario analyses articulate a possible view of the future, they should not be interpreted as predictions of future events. The goal is to understand the drivers of unexpected outcomes, the characteristics of decisionmaking environments, and the key issues for achieving policy goals. In recent years, scenario analysis techniques have

⁴ See Jon D. Haveman, Howard J. Shatz, and Ernesto Vilchis, *An Overview of Port Security Programs*, briefing presented at the University of Southern California Center for Risk and Economic Analysis of Terrorism Events Economics Symposium: Economic Costs and Consequences of Terrorist Attack, Los Angeles, Calif., August 20–21, 2004.

⁵ Defense Science Board Task Force, *Preventing and Defending Against Clandestine Nuclear Attack*, Washington, D.C.: Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, June 2004.

⁶ Richard L. Garwin, and Georges Charpak, *Megawatts and Megatons: A Turning Point in the Nuclear Age?* New York: Alfred A. Knopf, 2001.

been incorporated as the foundation for a number of high-level planning methodologies and strategic gaming.⁷

For our analysis, we used scenario analysis and strategic gaming in two contexts. First, we considered the range of direct effects from a terrorist nuclear attack on an American city, limited to time scales of 0 to 72 hours after the explosion. For the second phase, we used these initial scenario results to design a series of strategic games focusing on the decisionmaking challenges for the business and policy communities during the one to two weeks following the attack.

Our approach is novel in that we use scenario analysis and strategic gaming to link the analysis of the direct effects from an attack with plausible macro-level implications. While there has been considerable prior research on elements of this problem, ours is one of the first attempts to “connect the dots.” For example:

- Recently, CREATE, a center at the University of Southern California, carried out an economic analysis of the effects of a terrorist attack on the Port of Long Beach;⁸ however, this work involved a much smaller-scale attack than we considered in our analysis. As a result, the effects and the analysis of that study focused on the Los Angeles region.
- There have been a number of analyses of a terrorist nuclear explosion in a major urban area.⁹ This work largely focuses on the direct effects of the blast (e.g., fatalities, radiation doses, and fallout).
- There is a large literature on the causes, consequences, and possible solutions to economic crises;¹⁰ however, this work focuses almost exclusively on factors other than terrorism (e.g., currency devaluations and bank failures).

Nuclear Attack Scenario

To physically model the consequences of a terrorist nuclear attack, we utilize the large literature describing the effects of nuclear explosions, derived from the U.S. experience of developing, testing, and using these weapons. From this work, there are straightforward scaling relations to estimate the immediate and delayed effects for explosions of varying yields in various geometries (as shown in Table 1). Historically, much of the analysis of the effects of nuclear weapons

⁷ For example, see Robert L. Lempert, Steven W. Popper, and Steven C. Bankes, *Shaping the Next One Hundred Years: New Methods for Quantitative Long-Term Policy Analysis*, Santa Monica, Calif.: RAND Corporation, MR-1626-RPC, 2003.

⁸ Peter Gordon, James Moore, Harry Richardson, Qisheng Pan, *The Economic Impact of a Terrorist Attack on the Twin Ports of Los Angeles–Long Beach*, briefing presented at the University of Southern California Center for Risk and Economic Analysis of Terrorism Events Economics Symposium: Economic Costs and Consequences of Terrorist Attack, Los Angeles, Calif., August 20–21, 2004.

⁹ For example, Richard L. Garwin, *Nuclear and Biological Megaterrorism*, presented at the 27th Session of the International Seminars on Planetary Emergencies, Erice, Sicily, August 19–24, 2002.

¹⁰ For example, Lawrence H. Summers, “International Financial Crises: Causes, Preventions, and Cures,” *American Economic Review*, Vol. 90, No. 2, May 2000, pp. 1–16.

Table 1
Nuclear Weapon Effects

Effects	Comments
Immediate effects	
Blast wave	The blast wave is a pulse of pressure emanating from the explosion. For a 10-kiloton airburst, the blast wave would destroy most buildings to a radius of approximately one mile. For a surface explosion, the radius is reduced to approximately 0.6 miles. ^a
Flash radiation	Electromagnetic radiation, over a broad spectrum, emanates from the explosion. Because it is attenuated by air, the intensity decreases with distance. For a 10-kiloton airburst, everyone will be killed by lethal doses of flash radiation to a distance of 0.7 miles. ^b These effects would be attenuated by ground burst.
Delayed effects	
Radioactive fallout	The extent of fallout is sensitive to local wind conditions. If the fireball from the explosion does not touch the ground, fallout is limited to the particulate matter in the atmosphere. In contrast, ground bursts create large amounts of fallout by entraining surface materials in the nuclear reactions of the explosion. This fallout can be deposited over hundreds of square kilometers, creating regions that would be uninhabitable for at least several years. ^a
Fire	Fires are started by flash radiation and by disruptions from the blast wave. The spread of fire is largely controlled by the nature of local construction and geographic factors on the ground. Although the nuclear explosion in Nagasaki was almost twice as large as that at Hiroshima (22 kilotons compared with 12.5 kilotons), the area devastated by fire was four times as large in Hiroshima. ^a

^a Samuel Glasstone and Philip J. Dolan, eds., *The Effects of Nuclear Weapons*, 3rd ed., Washington, D.C.: U.S. Department of Defense, U.S. Department of Energy, 1977.

^b National Council on Radiation Protection & Measurements, *Management of Terrorist Events Involving Radioactive Material: Recommendations of the National Council on Radiation Protection and Measurements*, Bethesda, Md.: National Council on Radiation Protection & Measurements, Report No. 138, October 2001.

focused on airbursts, which were viewed as the primary military application because they generate the largest number of immediate fatalities, with minimal radioactive fallout.

In recent years, there has been growing analysis of these effects of ground-burst nuclear explosions, driven in part by the interest in using nuclear weapons against deeply buried targets but also because of the concerns related to terrorism.¹¹ This analysis has evolved to the point where there are Internet Web sites that will calculate effects by zip code.¹² (The long-standing assumption has been that a terrorist nuclear weapon would be delivered through ground transportation because of the technical challenges of detonating one high in the atmosphere using missiles or airplanes).

The key result from this work is that ground-burst nuclear explosions are extremely dirty from a fallout perspective because they generate large amounts of radioactive debris distributed over a large region (several hundred square kilometers or more depending on the yield of the weapon and the environment where the explosion takes place). By comparison, the immediate effects for ground-burst weapons are approximately half of optimum height of burst.

¹¹ Robert W. Nelson, "Low-Yield Earth-Penetrating Nuclear Weapons," *Science and Global Security*, Vol. 10, 2002, pp. 1–20.

¹² See <http://www.nuclearterror.org/blastmaps.html>.

For our analysis, we used Glasstone and Dolan's (1977) analysis of nuclear weapon effects, public domain software for analyzing radioactive fallout,¹³ and publicly available data on population, infrastructure, and winds in the Los Angeles region. For the analysis, we calculated the direct blast effects and assessed the affected infrastructure. Considering regional wind patterns and velocities, we modeled the magnitude and extent of the fallout patterns. We analyzed the health implications of these levels of radioactivity and calculated the affected populations. Finally, we considered evacuations and sheltering logistics in the Los Angeles region. The full scenario, which served as the foundation for strategic decisionmaking games described in the next section, is presented in Appendix A. The top-level results from the scenario are presented below:¹⁴

- The infrastructure and ships in the Port of Long Beach and the adjoining Port of Los Angeles are completely destroyed by the blast and fires.
- Sixty thousand people die or will die soon because of direct blast effects and radiation poisoning.
- The radioactive fallout of water and sediment from the port exposes 150,000 people to hazardous radiation levels, requiring prompt medical attention.
- Six million people will try to evacuate the Los Angeles region to avoid the radioactive fallout.
- Gasoline is in critically short supply because of the effects on refineries in the Long Beach area. Long Beach refines approximately one-third of gasoline west of the Rockies, and there is no pipeline infrastructure to import supplies to the region.
- Radioactive fallout contaminates a 500-km² region, prohibiting residence for 10–20 years. Two to three million residents will require relocation facilities.

The above results are consistent with previous estimates of nuclear weapon effects in large urban areas.¹⁵ In detail, our results are sensitive to the population and infrastructure near the blast site and to the population densities in the fallout regions.

Strategic Gaming

At times greater than approximately 72 hours after the attack, the consequences of the Long Beach attack will be difficult to predict because they will depend on complex interactions involving social, economic, and political factors, with influences from distant regions and

¹³ The Hotspot "Health Physics Codes for the PC" software tools are available at <http://www.llnl.gov/nai/technologies/hotspot/>.

¹⁴ For this analysis, we were assisted by P. Wilson, M. Gabrielle, M. Lostumbo, M. Tyszkiewicz, D. Ortiz, G. Cecchine, D. Mosher, R. Telschik, and R. Valdez.

¹⁵ For a discussion of the effects of a 10-kiloton explosion at Grand Central Station, see Matthew Bunn, Anthony Wier, and John P. Holdren, *Controlling Nuclear Warheads and Materials: A Report Card and Action Plan*, Cambridge, Mass.: Harvard, John F. Kennedy School of Government, March 2003.

stakeholders (e.g., Washington, D.C.). To explore this realm of the scenario analysis, we could not use direct calculation and modeling techniques analogous to the methods discussed above. As an alternative, we turned to strategic gaming, which has been well-developed at RAND over more than 50 years as a means of exploring highly uncertain policy landscapes.¹⁶ The goal for these types of games is to immerse the participants in the realism of a stressful event (in this case, the Long Beach attack) and to explore the decisionmaking challenges for various stakeholders. The results from these types of exercises are twofold. First, the decisionmaking process illustrates high-priority concerns for different stakeholder groups in response to the scenario events. This insight is provided as one considers what decisions are made in the exercise and which factors are weighed in making the decisions. Second, the exercises help to identify current policy solutions to mitigate the potential scenario consequences. This identification occurs as the participants reflect on the decisionmaking challenges and focus on preparedness, planning, and analysis strategies that could address these problems.

With this background, we carried out a series of strategic games with representatives of the insurance, real estate, business, and policy communities, using the initial scenario results, described above, as a stimulus for broader discussion on the national and economic consequences.¹⁷ In these games, the participants were briefed on the unfolding disaster in Long Beach, and they were asked for their perspectives on effects and response strategies. For exemplary purposes, in Appendix B, we present elements of the decisionmaking exercises used within a game with leaders of the insurance and real estate community.

As background for the gaming effort, we prepared notional estimates of the direct costs associated with the blast (shown in Table 2). These calculations suggest that the immediate costs could exceed \$1 trillion for this event, estimates that are compatible with previous economic assessments for nuclear blasts¹⁸ and even natural disasters.¹⁹ By comparison, estimates of the direct costs of the September 11 attack range between \$50 billion and \$100 billion.²⁰ Within this framework, the discussions and decisionmaking from the exercises help to illustrate the business and economic concerns that might arise from the Long Beach scenario.

¹⁶ For example, see Roger C. Molander, Andrew S. Riddile, and Peter A. Wilson, *Strategic Information Warfare: A New Face of War*, Santa Monica, Calif.: RAND Corporation, MR-661-OSD, 1996.

¹⁷ Strategic games were performed with the Advisory Board of the RAND Center for Terrorism Risk Management Policy, the Homeland Security Forum of the Real Estate Roundtable, and with congressional staff.

¹⁸ C. C. Abt, *The Economic Impact of Nuclear Terrorist Attacks on Freight Transport Systems in an Age of Seaport Vulnerability*, Cambridge, Mass.: ABT Associates, DTRS57-03-P-80130, 2003; Jonathan Medalia, *Nuclear Terrorism: A Brief Review of Threats and Responses*, Washington, D.C.: Congressional Research Service, September 22, 2004.

¹⁹ It has been estimated that a repeat of the 1929 Kanto earthquake would result in \$2.1 trillion–\$3.3 trillion in direct and business interruption losses in the Tokyo region. See Ross Stein and Shinji Toda, “Earthquake Probability Investigation of Greater Tokyo,” Menlo Park, Calif.: U.S. Geological Survey, n.d. Online at http://quake.wr.usgs.gov/research/deformation/modeling/tokyo/wn_tokyo.html (as of May 18, 2006).

²⁰ See Lloyd Dixon and Rachel Kaganoff Stern, *Compensation for Losses from the 9/11 Attacks*, Santa Monica, Calif.: RAND Corporation, MG-264-ICJ, 2004; Claire B. Rubin and Irmak Renda-Tanali, *The Terrorist Attacks on September 11, 2001: Immediate Impacts and Their Ramifications for Federal Emergency Management*, Boulder, Colo.: University of Colorado, Natural Hazards Research and Applications Information Center, Quick Response Report 140, 2001; International Monetary Fund, *World Economic Outlook: The Global Economy After September 11*, Washington, D.C., December 2001.

Table 2
Notional Direct Costs of a Long Beach Port Nuclear Explosion

Loss	Estimated Loss	Comments on Estimates
600,000 homes lost	\$300 billion	Estimated ~ \$500,000 per home
60,000 lives lost	\$20 billion	Estimated ~ \$350,000 in insurance benefits per life ^a
200,000 workers' compensation claims	\$80 billion	Estimated ~ \$400,000 per claim ^b
Port and surrounding infrastructure damage	\$100 billion	Estimated
3 million people evacuated for three years	\$300 billion	Estimated ~ \$100 per diem per person
1 billion commercial square footage lost	\$200 billion	Estimated ~ \$200 per square foot ^c
Total	~ \$1 trillion	

^a This was the average life insurance payment for deaths from 9/11. If the payments from the Victims Compensation Fund were included, the value would be almost an order of magnitude larger. See Dixon and Stern, 2004.

^b Estimated average claim from 9/11. See Dixon and Stern, 2004.

^c Estimates of commercial construction costs in southern California from Charles Meade, Jonathan Kulick, and Richard Hillestad, *Estimating the Compliance Costs for California SB1953*, Oakland, Calif.: California HealthCare Foundation, 2002. Online at <http://www.calhealth.org/public/press/Article%5C103%5CFinal%20RAND%20Report.pdf> (as of May 18, 2006).

The principal insights from the games focused on the extreme challenges for strategic decisionmaking following a catastrophic attack such as the Long Beach scenario. There seemed to be two principal drivers: (1) the scale and character of the terrorist attack and (2) a heightened desire to mitigate risks for future terrorist attacks following the one in Long Beach. Reflecting the first point, all discussions of response strategies, on local and national scales, were challenged by the fact that the effects far outstripped the available resources. The problems ranged from the allocation of medical supplies in the Los Angeles region, to the distribution of gasoline in California and most of the western United States, to the compensation of losses on a national scale. Discussions on the second point were driven by the natural fear that the Long Beach scenario might be followed by a second similar attack in another U.S. port. While this response might seem rational if one focused on the strategic goals for U.S. adversaries, it is also important to note that this a common feature of the human response to risks (i.e., stringent risk mitigation measures are often implemented in response to recently perceived threats).²¹ The problem for this issue, as illuminated by the games, is that the risk of a second attack cannot be mitigated 100 percent without closing all U.S. ports and suspending all imports.

The interplay of these issues in the strategic games illustrated an important difference in the response to catastrophic terrorism compared with that for large-scale natural disasters. Historically, society has been able to heal from sudden natural disasters that occur without

²¹ Roger E. Kasperson, Ortwin Renn, Paul Slovic, H. S. Brown, J. Emel, R. Goble, Jeanne X. Kasperson, and S. Ratick, "The Social Amplification of Risk: A Conceptual Framework," *Risk Analysis*, Vol. 8, pp. 177–187, 1988.

warning by mitigating the immediate effects (e.g., caring for the wounded) and rebuilding the damaged infrastructure.²² That is, the response largely focuses on the scale and character of the initial event, with only limited efforts to mitigate the risks of immediate follow-on events. Emphasizing the immediate response to a disaster, countries throughout the world have recovered from truly catastrophic events, involving many thousands of deaths and huge economic losses. Examples include the 1906 San Francisco earthquake, which destroyed the city and left 250,000 homeless; the 2004 South Asia tsunami, which killed over 200,000 people from all over the world; the 1976 Tangshan, China, earthquake, which killed 255,000 people; and the 1970 storm surge in Bangladesh, where 300,000 people and 500,000 cattle drowned. In some cases, the economic activity to rebuild from these types of events has been viewed from a positive perspective.²³ In the recent case of Hurricane Katrina, the human casualties were substantially lower; yet there was significant damage to critical economic infrastructure and flooding damage to a large urban region. While there is a continuing debate on rebuilding and resettlement of the affected population, it seems clear that the damage from Katrina will be limited when viewed from a national economic perspective.

Discussions during the strategic games provide a stark comparison from the decision-making challenge following a catastrophic terrorist attack. As an example, the insurance and real estate leaders focused on the challenge of restarting the economy following the attack with only limited availability for insurance. They estimated that the attack would threaten the solvency for many of the largest insurance concerns, either because of direct claim liabilities or because of secondary losses in the financial markets. Most of the insurance liability would involve workers' compensation and life insurance, with other possibly large claims involving fire and business interruptions. By comparison, commercial and property insurance contracts have excluded coverage for any nuclear effects (from weapons or nuclear power plants), along with acts of war.²⁴ Although insurers have been issuing terrorism-specific insurance over the past two years, these policies also include nuclear exclusions.

Following the Long Beach attack, the game participants estimated that there would be extreme shortages in the availability of insurance, especially for terrorist and nuclear risks. And without these lines of insurance coverage, it would be difficult for many businesses to operate. On this point, the continued operation for other U.S. ports and the global shipping chain seemed especially problematic. Setting aside the national security concerns, which would probably dominate the policy discussions, it might be impossible for many ports to operate, simply because their creditors would demand insurance coverage for the physical assets; yet this coverage would be unavailable on the open market.

²² In this characterization, we are excluding acts of war and large outbreaks of disease, which can have much larger social effects.

²³ Regional banks have indicated that there may be a positive economic effect from the 2004 tsunami because of reconstruction activities. See Asian Development Bank, *An Initial Assessment of the Impact of the Earthquake and Tsunami on December 26, 2004, on South and Southeast Asia*, Mandaluyong City, Philippines: Asian Development Bank, January 2005.

²⁴ See Daniel Andris, Georges Galey, Sebastiaan Reitsma, and Richard Walker, "Nuclear Risks in Property Insurance and Limitations of Insurability," Zurich, Switzerland: Swiss Reinsurance Company, Focus Report, 2003.

Synthesizing these types of discussions from the range of strategic games with over 200 participants, we found that two issues emerge as significant challenges from a decisionmaking perspective for political and business leaders: continued operation of the global shipping supply chain and maintaining orderly economic relationships.

Continued Operation of the Global Shipping Supply Chain

The principal challenge on this issue involves the conflict between the political desire to mitigate the risks of future attack compared with the business requirements for continued operation of the ports and the global shipping supply chain. The results of the strategic gaming indicate that the political and economic forces on this issue would be complex, making it difficult to identify possible solutions in advance. Viewed from a national security perspective, there could be an immediate call to close all U.S. ports to incoming traffic. In contrast, parts of the business community might advocate an early opening of the ports. However, financial and real estate interests may require financial risk protection before shipping could resume, and this would be almost impossible to acquire following the Long Beach explosion. At the same time, there could be a large-scale exodus from U.S. port cities by local populations fearing the prospect of a second attack. Taken together, these results suggest there are reasonable prospects for extended closures of *all* U.S. ports following the Long Beach scenario, or at least for periods of substantially reduced operations. The issue is analogous to the cancellation of airline traffic following the 9/11 attacks, but the problem is much greater given the difficulties of screening 20,000 shipping containers per day originating from ports all over the world.

From a business perspective, the problems revolve around the vital economic role of U.S. ports and the global shipping supply chain.²⁵ Taken together, the Ports of Long Beach and Los Angeles are the largest port of entry to America, and the third largest in the world, handling 30 percent of U.S. shipping imports by value in 2003. If all U.S. ports were closed, it would have large economic implications for almost all domestic business operations, and it would lead to severe disruptions in the availability of basic goods and petroleum in the United States. That is, there is a high probability that the Long Beach scenario would have large economic consequences at great distances from the initial nuclear explosion. It would also have important repercussions for global business activity because the value of imports and exports from all U.S. ports represents 7.5 percent of world trade activity.²⁶ In the wake of these economic effects, it seems reasonable to assume that there would be large declines in world stock markets, in contrast to the relatively limited financial losses that followed the 9/11 attacks.²⁷ While those attacks were unprecedented, they had only minor consequences for the economic infrastructure of the United States.

²⁵ See Henry H. Willis and David S. Ortiz, *Evaluating the Security of the Global Containerized Supply Chain*, Santa Monica, Calif.: RAND Corporation, TR-214-RC, 2004.

²⁶ International Monetary Fund, *World Economic Outlook*, Washington, D.C., April 2005.

²⁷ From a historical perspective, the U.S. stock market losses following September 11 were not exceptional. See David A. Carter and Betty J. Simkins, "The Market's Reaction to Unexpected, Catastrophic Events: The Case of Airline Stock Returns and the September 11th Attacks," *Quarterly Review of Economics and Finance*, Vol. 44, No. 4, pp. 539–558, September 2004.

Maintaining Orderly Economic Relationships

There would be a number of challenging policy questions stemming from the consequences for financial relationships within America and internationally, many of which are difficult to quantify a priori. For example, a large number of loans and mortgages in Southern California, in some cases for very large buildings, would probably default. As noted above, there probably would be bankruptcies in some of the largest insurance firms. And the highly leveraged investors that operate in some of the largest financial markets might find themselves unable to meet their outstanding contractual obligations for futures and derivatives. The implications from these types of events are difficult to predict, but they suggest that there could be severe challenges to the global economy following an attack like the Long Beach scenario. The strategic gaming conducted for this research indicated that restoration of order to economic relations, while addressing large-scale demands for loss compensation, would be a difficult and continuing driver for decisionmaking for many months following the attack.

Concluding Thoughts

We have developed policy analysis tools to explore the effects of a catastrophic terrorist attack on a key economic resource of the United States. The tools, presented in detail in this technical report, include a detailed scenario analysis of a terrorist attack and the immediate effects, together with strategic gaming, to explore the longer-term implications. For this first application, we have focused the analysis on a hypothetical attack involving a nuclear detonation in the Port of Long Beach. As detailed by the scenario analysis, the attack would devastate much of the Los Angeles region. Results from the strategic games, using this scenario, indicate that the consequences could easily spread to national and international scales. Key insights from the games focus on the challenges for strategic decisionmaking following a catastrophic terrorist attack and the mechanisms that may propagate economic effects far from the site of the initial attack.

The principal conclusions stemming from this work focus on the importance of the decisionmaking landscape following a catastrophic terrorist attack. While there has been considerable analysis of the immediate effects of a variety of terrorist scenarios with implications for emergency response strategies, this work is the first to illuminate the critical economic contingencies driven by decisionmaking in the extended period after a catastrophic attack.

Given the pressing policy concerns involving critical infrastructure and the vulnerabilities to terrorism, we believe there is a need for continued investigations of the longer-term economic effects of catastrophic events. Building on this initial effort, work would proceed in two phases. Initially there would be a need for exploratory modeling of the system-level interactions and possible outcomes for economic systems following a catastrophic event such as the Long Beach attack. While the results from this work would be somewhat qualitative compared with past quantitative modeling of economic systems, it would help to illuminate unique and potentially unprecedented behavior that could occur in the global economy in times of extreme duress. In the second phase of the work, the modeling would provide the analytic foundation to develop scenarios for a new generation of strategic games, focused on policy and

economic decisionmaking in the months following a catastrophic attack. Important goals for those games would be to investigate the robustness of the scenario analyses and to understand to what degree the outcomes are contingent on the details of the attack scenario. There are also needs to identify the locus for key points of failure in current social and economic systems and to assess the benefits of new policy frameworks. The overall goal for this analysis would be a full characterization of the scenario-decision landscape following an attack so that advanced exploratory modeling tools can then be used to identify new policy solutions for key response systems.²⁸

²⁸ For example, see Lempert, Popper, and Bankes, 2003, for illustration of exploratory modeling techniques.

Scenario Description for the Strategic Decisionmaking Games

The following narrative describes the scenario analysis of the nuclear explosion in the time period of 0–72 hours after the attack. This presentation was incorporated into the strategic games described in the text and Appendix B. The time frame for the scenario is spring 2005 because the strategic games were performed in the fall and winter of 2004/2005. All overlays on the maps in the figures below are based on data compiled and analyzed by the authors.

Monday, 14 March 2005

Long Beach Harbor—1130 PST (1430 EST)

On a routine Monday morning, inspectors at the Port of Long Beach are responding to the latest regulations on enhanced container inspection for both incoming containers from overseas as well as containers to be shipped from Long Beach to ports farther north and in Asia.

At 1130 PST a call from one of the inspectors at Pier E (see Figure A.1) to his crew chief reports an unusually high radiation signal from a container that he has just entered and surveyed. Pier E is operated by California United Terminals. They primarily handle incoming containerized cargo such as clothes, toys, and furniture and ship out containerized machine tools and other heavy machinery.

Port of Long Beach—1200 Noon PST (1500 EST)

At the Port of Long Beach a nuclear weapon detonates in a tremendous explosion heard and seen throughout the Los Angeles basin. Large quantities of materials and water are immediately sucked into a forming cloud of debris, and a large mushroom cloud begins to rise from the port area.

As a result of the explosion there is damage to structures and people are injured by flying debris as far as 1.6 miles (2.5 km) from the blast center (see Figure A.2). Physical damage to the city of Long Beach from the blast wave is relatively light (broken windows and flying debris, but roofs mostly intact) and limited to the southeast corner of town, but that area is a business center, full of office workers.

Figure A.1
The Port of Long Beach, California



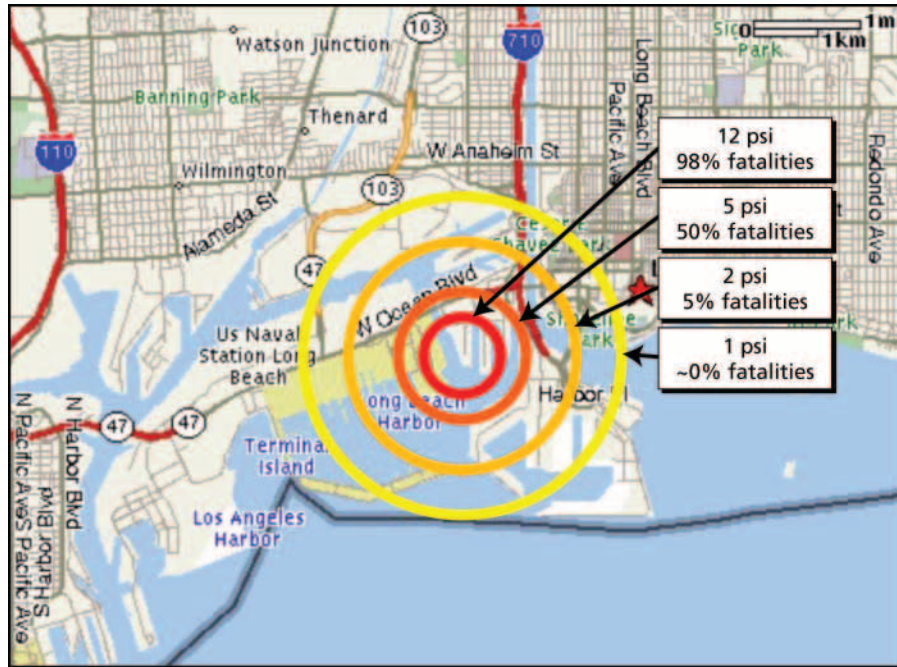
SOURCE: The Port of Long Beach, 2006.
 RAND TR391-A.1

People within approximately 2.2 miles (3.5 km) of the blast center who were not shielded by buildings or other structures suffer from flash burns over the portion of their bodies that is facing the port (see Figure A.3). The affected area reaches as far as Long Beach Plaza. The hill-side community of San Pedro, due west of the blast site, receives disproportionately extensive damage due to its direct line-of-sight to the blast area.

People within approximately 0.75 miles (1.2 km) of the blast center who were not shielded absorb dangerously high prompt doses of radiation, although these effects are limited to the port area (see Figure A.4) and miss the city. Those who were exposed to fatal levels of radiation may not develop symptoms for hours or even a few days. They may take days or even a few weeks to die.

As a result of the blast, containers from neighboring cargo ships are scattered at high velocity. Some ships suffer hull ruptures at the waterline on the side facing the explosion, including a crude oil tanker that was off-loading crude at Pier T. Crude from the tanker begins to flow rapidly into the harbor and is soon ablaze.

Figure A.2
Blast Effects



SOURCE: Map and content © 2006 by MapQuest, Inc. Used with permission.

RAND TR391-A.2

The prompt flash of radiation from the nuclear detonation temporarily blinds hundreds of drivers along the major highways throughout the L.A. basin, immediately causing a series of massive accidents and traffic jams throughout the L.A. basin. Most severely affected are the main highways within ten miles of the detonation.

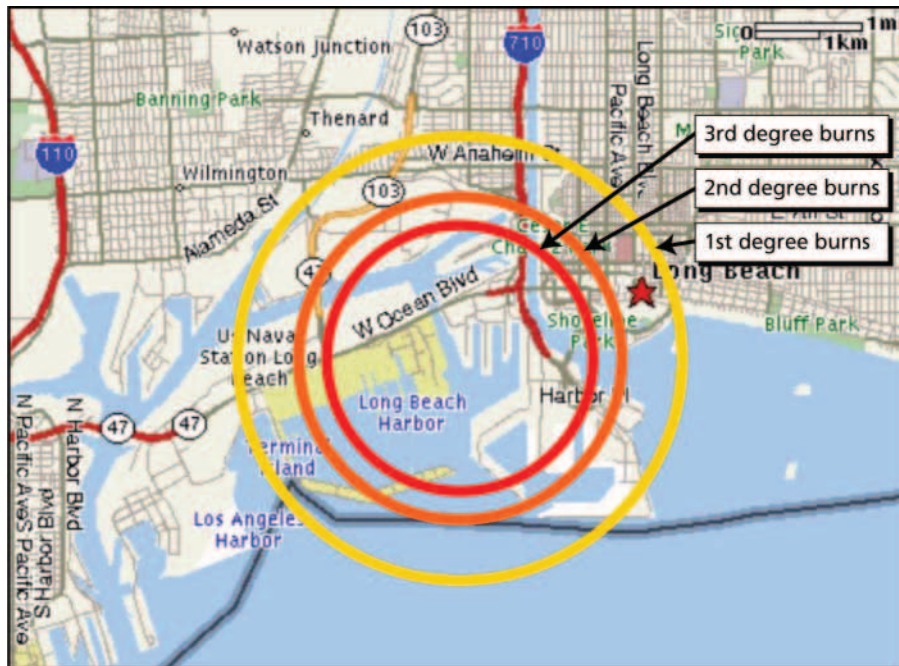
Destruction and damage of the power grid nodes in the vicinity of the port cause widespread power outages throughout the Los Angeles area. In addition to the blast effects, the electromagnetic pulse (EMP) from the explosion destroys most electronic equipment within roughly a one-mile radius of ground zero.

Fires rapidly begin to burn around the port area and in the southwest corner of the city of Long Beach. Paper, wood, and other combustibles up to 2 miles from ground zero are ignited, setting many fires that quickly begin to burn out of control.

USSTRATCOM, Colorado Springs—1205 PST (1305 EST)

The nuclear detonation detection devices aboard the GPS [Global Positioning System] satellites detect the signature of a detonation and report the location to their control center at Schriever AFB [Air Force Base], Colorado. The detection is of extremely high confidence, and the exact coordinates of the blast are immediately determined: a surface burst at Pier E, Long Beach Harbor, California. The initial estimate of the yield of the weapon is between 10 and 12 kilotons.

Figure A.3
Burn Effects



SOURCE: Map and content © 2006 by MapQuest, Inc. Used with permission.

RAND TR391-A.3

The president and other relevant officials including the vice president, secretary of defense, commander of the Northern Command, and national security advisor are immediately notified.

USSTRATCOM, Omaha—1208 PST (1508 EST)

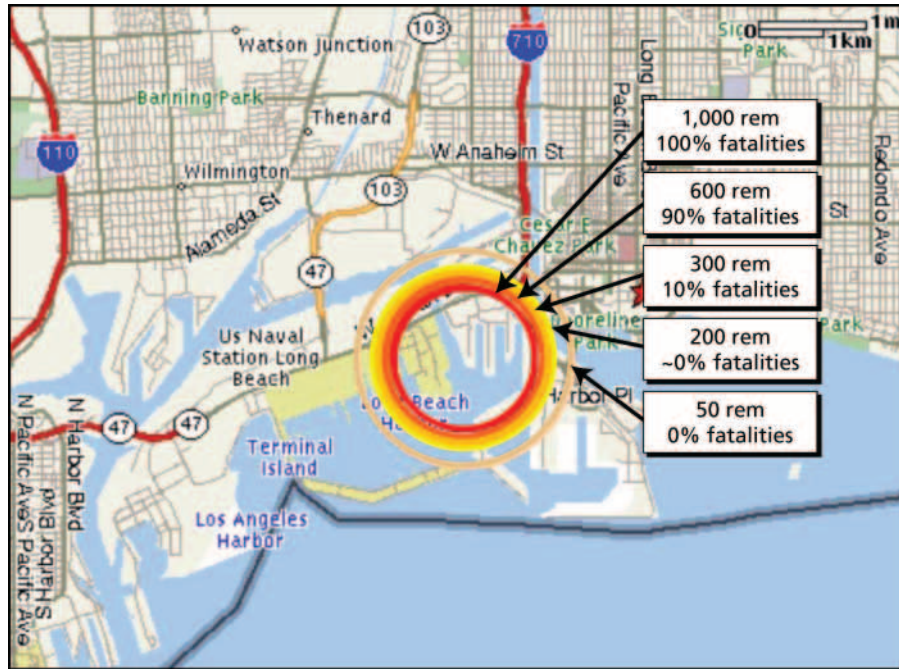
Officials at U.S. Strategic Command, in consultation with the FAA [Federal Aviation Administration] and the Coast Guard, determine that there were no missile launches globally or evidence of unidentified aircraft or cruise missiles in the area, indicating that the weapon was located on the ground and most likely had been in a container either coming into or leaving the port of Long Beach.

L.A. Basin—1210 PST (1510 EST)

The cloud from the detonation is near its maximum height of 20,000 feet and has begun to spread out forming a classic mushroom cloud. Highly radioactive local fallout from the cloud begins to fall within and just beyond the 1 psi ring and on areas a few kilometers north of the port, carried by an 8–10 mph wind from the south.

The L.A. County emergency operations center activates its response plan for a nuclear event. Anticipating evacuations, the L.A. County sheriff orders officers to begin clearing the inbound lanes of major freeways by blocking off access to on-ramps.

Figure A.4
Radiation Effects



SOURCE: Map and content © 2006 by MapQuest, Inc. Used with permission.

[NOTE: rem—roentgen equivalent man (or mammal)—a unit of biological dose of radiation. The number of rems of radiation is equal to the number of rads absorbed multiplied by the RBE of the given radiation (gamma rays or beta or alpha particles) for a given effect.]

RAND TR391-A.4

Washington D.C.—1210 PST (1510 EST)

The secretary for DHS [Department of Homeland Security] alerts the IIMG (Incident Interagency Management Group)—a group of senior officials of all relevant federal agencies who will recommend courses of action, obtain situation awareness, and coordinate their agency actions. This group includes a representative of the Infrastructure Coordination Division of the Office of Infrastructure Protection and Private Sector Office.

The Media—1210–1215 PST (1510-1515 EST)

Local, national, and international media begin to break the story that a nuclear weapon has detonated in Long Beach harbor. Many of the immediate reports are local feeds from camera crews who provide digital pictures of the mushroom cloud and expanding fires in and around Long Beach.

Not surprisingly, there is initially considerable misinformation about the estimated size of the detonation and the location and consequences of the likely local fallout. Several local

commentators suggest that the entire L.A. basin should be evacuated. Others recommend that all L.A. residents not immediately affected by the detonation should stay indoors and “shelter in place” to protect themselves from the fallout.

New York City—1210 PST (1510 EST)

The New York Stock Exchange plummets when CNN announces the nuclear attack. Computer limits kick in minutes later, halting trading for the day. Global equity markets suffer similar losses. Noteworthy is the “near collapse” of oil prices based upon many forecasts in the global business media that the disruption caused by the L.A. nuclear explosion will throw the United States into a deep recession, thereby precipitating a global recession.

L.A. Basin—1215 PST (1515 EST)

Early fallout is detected by firefighters three kilometers north of the port. High levels of radiation force them to retreat to the west.

Early estimates indicate that fallout will continue to be deposited downwind for approximately 24–48 hours, but just where the winds will blow the fallout remains uncertain. Initial projections based on surface wind speeds predict a fallout zone extending north of the port (see Figures A.5 and A.6), but experts warn that winds in the region of 20,000 feet are highly variable, based on prevailing wind patterns.

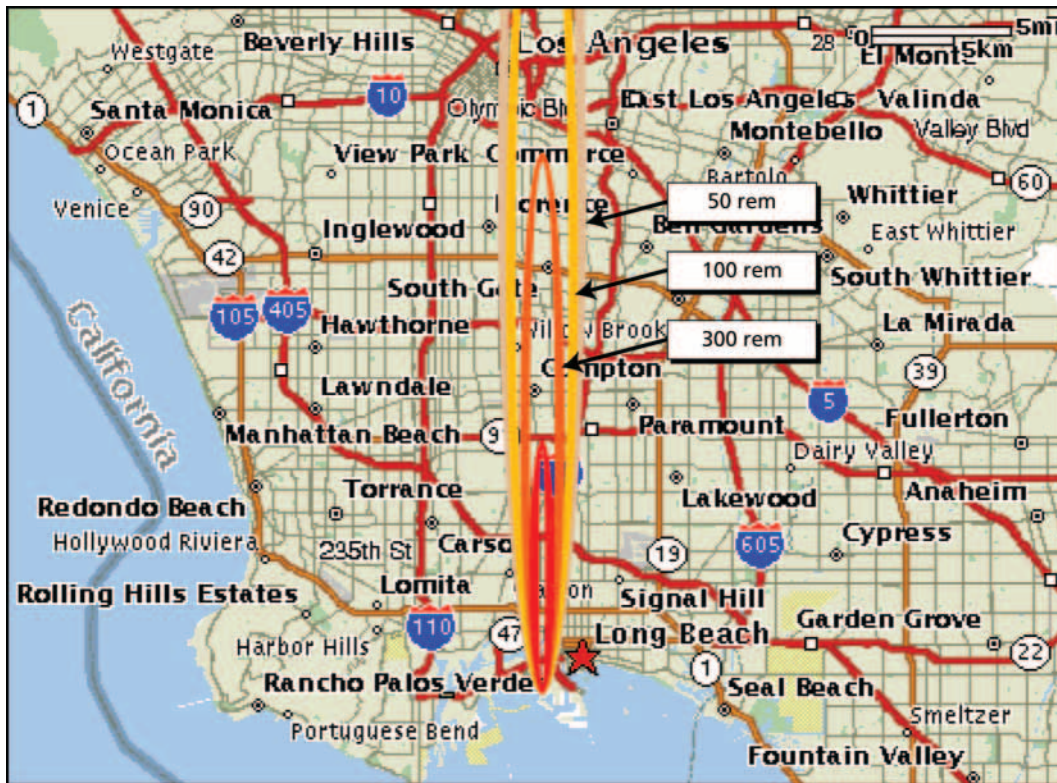
The L.A. Sheriff’s order to block access to on-ramps and begin one-way freeway traffic is immediately reported by radio and TV stations. Aerial TV shots indicate clearly that a mass exodus from the region, especially from areas with a clear view of the mushroom cloud, has begun to take place. However, traffic off the freeways is moving very slowly because the blackout has affected most traffic signals and there have been numerous traffic accidents as a result of flash blindness.

Fires are now raging out of control at the port, fuel facilities, and the surrounding waters from badly damaged ships and the tanker near the blast. First responders are not able (or allowed) to take action because of the high radiation levels from the early fallout. Visibility is severely limited by black smoke from the oil fires, which are also predicted to resuspend radioactive particles into the air.

Landlines and the few cell phone towers that remained operational immediately after the initial blackout were quickly overloaded and are no longer operating. As a result many people who were at work begin trying to head home to reunite with their families or pick up children from school.

Government Emergency Telephone Service (GETS) and Wireless Priority Service (WPS) remain effective on landline phones, where phones are available and in service.

Figure A.5
Initial Projection of Fallout Exposure After 24 Hours



SOURCE: Map and content © 2006 by MapQuest, Inc. Used with permission.
RAND TR391-A.5

Washington D.C.—1215 PST (1515 EST)

The president, at a speaking engagement in New York, is immediately whisked away by the Secret Service to a waiting helicopter for a fast trip to Air Force One with an interim destination of Offutt Air Force Base, Omaha, where there is a CBRN [chemical, biological, radiological, and nuclear] protected command bunker. En route, the president convenes a secure teleconference with his national security team to discuss the situation and determine the best course of action. Discussion quickly focuses on the risk of other weapons in other ports or already in other locations inside the United States. While this would appear to be a terrorist incident of foreign origin, the possibility of a domestic terrorist attack is not immediately ruled out.

After an initial assessment of the situation, he orders that all U.S. ports be immediately closed and that all shipping to U.S. ports be halted and all rail and truck traffic carrying containers be moved to locations outside of the major metropolitan areas to allow for urgent emergency examination of their cargo. Finally, as a precaution, he orders the immediate stand-down of all commercial air traffic.

Figure A.6
Initial Projection of Fallout Exposure After 24 Hours (Large Scale)



SOURCE: Map and content © 2006 by MapQuest, Inc. Used with permission.

RAND TR391-A.6

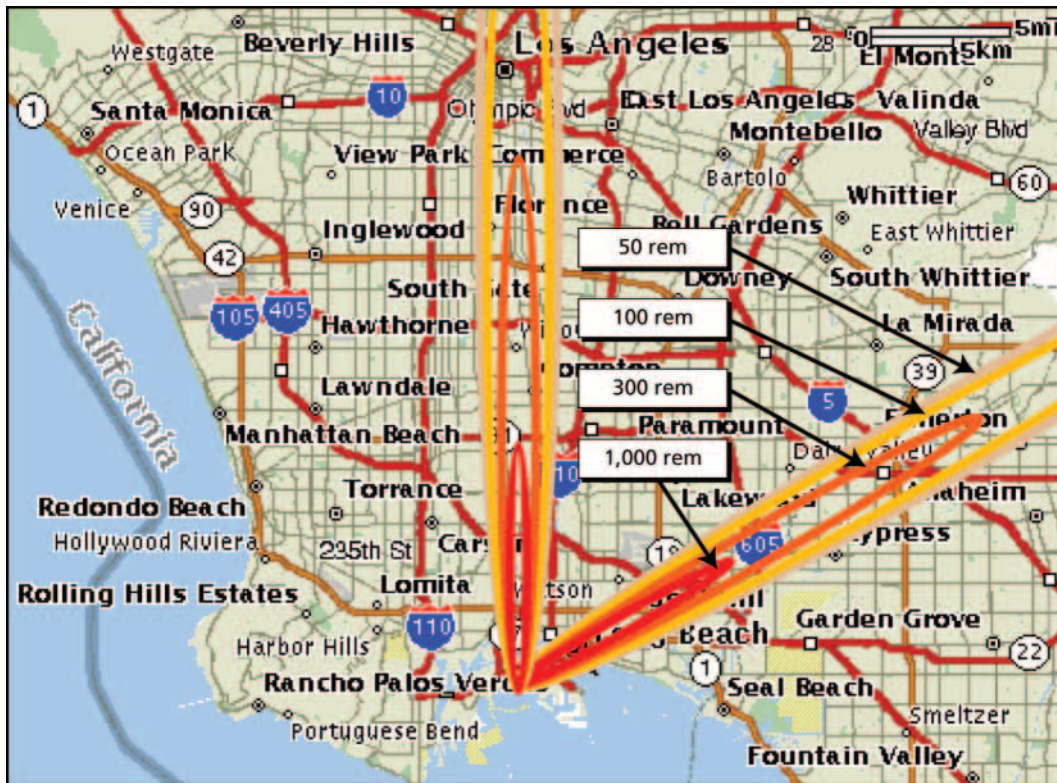
Livermore, California—1217 PST (1517 EST)

At Lawrence Livermore National Laboratory, scientists begin to start up the Atmospheric Release Advisory Capability to model the fallout from the event using current weather data.

Los Angeles—1218 PST (1518 EST)

The City of Los Angeles Emergency Operations Center [EOC] predicts that fallout will likely reach downtown L.A. if the top of the mushroom cloud continues to move north. It establishes contact with the state EOC and experts at Lawrence Livermore National Laboratory to discuss fallout projections. Initial models available to EOC personnel show potential fallout plumes but suffer from enormous uncertainties, especially in wind direction. Officials quickly find themselves examining conflicting fallout projections. One set assumes the wind continues from the south (Figures A.5 and A.6). Another set assumes that the prevailing wind patterns dominate and the cloud begins to move toward the east-southeast (Figure A.7).

Figure A.7
Alternative Estimates of Fallout After First Day



SOURCE: Map and content © 2006 by MapQuest, Inc. Used with permission.
RAND TR391-A.7

L.A. Basin—1220 PST (1520 EST)

Upon observation of the blast and mushroom cloud, all refineries and processing facilities within the L.A. basin have initiated emergency shutdown procedures. This must be accomplished with reduced staff, however, as some workers leave immediately after seeing the effects of the explosion. This shutdown procedure involves burning off fuel products and venting thousands of tons of petroleum combustion products into the air.

Further news reports suggest that due to “uncertain weather conditions” all L.A. residents within 20 miles of Long Beach should either leave or try to find shelter from the fallout.

Two L.A. media helicopters overfly a scene of utter traffic chaos and gridlock. Early television pictures show all of the major highways in the L.A. basin as blocked with cars, trucks, and buses. In several mass collision sites around the highway infrastructure there are large fires burning. Before withdrawing, both helicopters provide pictures of thousands of people abandoning their vehicles and attempting to walk away from the fallout zone.

L.A. Basin—1230 PST (1530 EST)

Most radio stations survive the effects of the weapon and many of them are able to continue broadcasting with backup generators. Several local TV stations are off the air because they have no emergency power. The L.A. EOC has activated the emergency broadcast system and begins broadcasting messages that tell people that there was a nuclear explosion at the Port of Long Beach and ask them to remain calm and stay where they are, preferably indoors in an inside room without windows or skylights, until they receive further instructions. People in high-rise buildings are urged to stay inside and move to the upper floors but remain at least 3 stories below the roof. People in cars or who have radios with batteries are able to receive the broadcasts.

More people begin evacuating the city or trying to get home. Traffic jams are beginning to spread to major arteries on the outskirts of town, particularly those leading out of the city.

Nationwide—1230 PST (1530 EST)

Many people in other cities are beginning to leave work and collect children from school for fear of coordinated attacks in other cities. In some of the West Coast cities with large ports, traffic flows are indicating that some people are choosing to evacuate the cities as a cautionary measure.

Washington D.C.—1235 PST (1535 EST)

The DHS secretary convenes a video conference with the Department of Energy (DOE) secretary and the combatant commander of USNORTHCOM. All agree that a mobilization order should be given to all of the Radiological Assistance Program (RAP) teams and Aerial Measurement Systems (AMSs) in the United States.

L.A. Basin—1245 PST (1545 EST)

Mass panic begins to spread across the L.A. area as increasing numbers of residents—estimated as “millions” in most media broadcasts—attempt to evacuate the city.

Arguments erupt at some schools when parents attempt to pick up their children and learn that the school will not release them based on policies instituted after the 9/11 attacks.

The Media—1250 PST (1550 EST)

News programs in L.A. and CA interview experts who speculate about the probable extent of the fallout plume and encourage those in its path to evacuate. Several of these experts disagree about the extent of the fallout zone and which people should evacuate. Meanwhile, mistaken reports of other potential bombs begin surfacing in the local and national media, with major buildings and landmarks in many cities receiving bomb threats.

It is clear that this unconstrained public affairs environment will be a major headache for the crisis public affairs operation being run out of a state-managed Joint Information Center (JIC).

Washington D.C.—1300 PST (1600 EST)

The president, still in transit to Omaha aboard Air Force One, declares a state of emergency and raises the homeland security threat condition to RED for the West Coast and all U.S. ports and ORANGE for the nation as a whole. He also orders the immediate dispatching of all appropriate federal civilian and military assets to the state [California].

At an ensuing national security teleconference, the secretary of DHS provides a summary of initial estimates of the damage caused by the nuclear weapon detonation at Long Beach based on “overhead surveillance and local reporting:”

- The bomb probably caused more than 5,000 prompt fatalities.
- There are probably several thousand serious burn victims, a number that could go much higher since thousands of children were likely to be outside during their lunch break.
- The local health care system has all but collapsed due to the local damage, power outages, and spontaneous evacuation of many hospitals in the L.A. basin.
- The fatality number is expected to rise sharply as a result of the fallout and people’s inability to escape the heavy fallout region, with the possibility that more than 100,000 fatalities might result from fallout alone—a consequence of the bomb going off on the ground and throwing up thousands of tons of radioactive debris and water.

The president orders the Coast Guard and U.S. Navy to close all seaports until further notice and to move all ships at least five miles off the coast until the security situation is better understood. He also reaffirms his order that the Federal Railroad Administration direct all trains with containers from ports to unpopulated areas where they can be searched.

The president instructs the secretary of DHS to inform TSA [Transportation Security Administration] that it is to ensure that trucks that have carried containers from ports in the last 24 hours are moved to remote locations where they can be searched.

The president also stands up an interagency task force to be led by the secretary of DHS and including representatives from the Coast Guard, DOT [Department of Transportation], TSA, and CIA [Central Intelligence Agency]—and tasked to determine the likely origin of the weapon.

L.A. Basin—1310 PST (1510 EST)

Debates in the L.A. EOC, in consultation with state and federal experts, continue about the expected extent of the fallout plume and the area that should be evacuated. Results of detailed simulations provided by Livermore about the predicted extent and movement of the fallout are important inputs, but it is clear that uncertainty about atmospheric conditions in the L.A. basin make any determination difficult without actual measurements.

The mayor of L.A., in consultation with the director of the EOC, makes the decision to order the evacuation of the parts of the L.A. basin where radiation levels could be life-threatening over the next 24 hours—defined as 300 rem or greater over the first 24 hours.

In the absence of better information about whether the fallout will go to the north from Long Beach or to the east, the EOC orders everyone to evacuate the area between the I-110 to the west, the I-10 to the north, Route 57 to the west, and the coast to the south. However,

they urge everyone in that zone in high-rise buildings or who can shelter in a garage at least two levels underground to remain where they are. Concerns are expressed about the ability of public safety assets to evacuate such a large area.

In the announcement that goes out over the emergency broadcast system, officials urge everyone else to remain where they are and to get indoors if possible without abandoning their cars. All inbound lanes of traffic on freeways heading into the L.A. basin are ordered closed pending being reopened for the outgoing evacuation traffic.

Anticipating a surge in casualties, hospitals throughout California have begun to clear non-critical surgeries, and non-critical in-patients are being discharged. Some facilities are setting up decontamination tents outside their emergency rooms. Ambulances have begun to arrive with casualties. Many people are also arriving on their own and demanding medical attention.

Hospital personnel begin to scan incoming patients for radiation contamination. Those who are contaminated are decontaminated before entering the hospital and given a change of clothes.

Sacramento—1320 PST (1520 EST)

The governor of California orders the full mobilization and deployment of the National Guard and requests immediate federal assistance, most specifically specialized combat engineering units to assist in the clearing of the blocked L.A. basin highway system.

Washington D.C.—1330 PST (1630 EST)

The president directs the secretary of defense to order combat engineering and other support units from the Marine 1st Division at Camp Pendleton and the 25th Division at Fort Lewis, Washington, to provide “immediate assistance.” Other Army units in Kansas and Texas are ordered to prepare relevant emergency support units if required.

Teams from national laboratories and other experts are dispatched to take measurements to determine the extent of the fallout.

The Media—1330-1400 PST (1630-1700 EST)

Grotesque pictures of victims with radiation burns arriving at hospitals are on the news. Seeing the commotion at the hospitals causes many citizens to fear that authorities are not prepared to respond to the attack.

Images of the blast area from several news helicopters are shown on the news and cause further panic. Most dramatic are the images of most of the L.A. basin interstate system jammed with abandoned vehicles.

Overhead TV coverage becomes increasingly spotty as it becomes known that several aerial television crews have unexpectedly become ill from radiation exposure. Further, a number of major television stations close down as all news personnel evacuate.

L.A. Basin—1400–1430 PST (1700–1730 EST)

An EOC assessment makes clear that many cars are now likely running out of gas and many are low on gas and searching for fuel. However, most stations in the L.A. basin are now

closed, either because of the blackout or because their supplies have been exhausted. Fights are reported to be breaking out among drivers jockeying for position in the few lanes that remain open, some of which result in gunshots. Almost any open station quickly runs dry as cell phones communicate their location.

Grocery stores are swamped with people trying to stock up on water and food. Many employees evacuate, leaving the stores undermanned to deal with the surge. People begin to loot from deserted or poorly guarded stores. Violent altercations escalate, with an overwhelmed police infrastructure reporting the increased use of firearms.

Hospitals are becoming overwhelmed with patients. Some appear to be “worried well.” The delayed nature of radiation sickness and uncertainty about where the fallout is landing make a “no exposure” diagnosis difficult. Some patients are demanding that the hospital provide them with “radiation pills.”

The attempts by what some estimate as “more than 5 million people” to evacuate the L.A. basin have been severely hampered by massive, systemic gridlock that is caused by both volume and abandoned vehicles. Dozens of motorists have been shot by angry, desperate drivers who are stuck in traffic. Police units trying to reverse traffic on the inbound lanes of the freeway are undermanned and hampered by the gridlock in those lanes as well. Drivers stuck on some of the major routes in the evacuation zone also run the risk of exposure to high levels of radiation.

The gridlock has made it impossible for people to evacuate the area, except by walking, called for by the L.A. officials. This makes them vulnerable to dangerous radiation unless they are able to walk quickly and are near the edges of the evacuation zone.

Staff from the Department of Energy’s Radiological Assistance Program and the Aerial Measuring System begin field measurements to characterize the fallout area. The full extent of the fallout is just being realized.

Reno, Nevada—1430 PST (1730 EST)

Concerned about contamination that could be brought into his state, the governor of Nevada decides to seal his border with California with state police and national guard troops.

Twenty minutes later, after extensive arm twisting, the president convinces him to reverse his decision.

Oman—02:00 local time, Tuesday, March 15

Al Jazeera reports that a tape purporting to be from an Al Qaeda–linked organization claims “the fires of vengeance have only begun to burn in the home of Satan.”

Washington D.C.—1500 PM PST (1800 EST)

The president orders that all containers on the diverted railcars and trucks be searched. The National Guard’s WMD Civil Support Teams and the Department of Energy’s NEST [Nuclear Emergency Search Team] is tasked with this mission.

In response to a direct question, the president’s press secretary acknowledges that federal officials cannot exclude the possibility of follow-on attacks or that one or more additional nuclear weapons may already be in the United States.

(Step 1) March 15, 2005**In the Long Beach Area of Damage—0530 PST**

The port of Long Beach is a smoldering ruin, contaminated by highly radioactive fallout. San Pedro Bay itself continues to burn, fed by the damaged tanker full of crude oil. The harbor is littered with capsized and partially sunken ships.

The port of Los Angeles has been much less affected, but an assessment of the damage and serviceability will not occur for at least a week. The nationwide port closure announced by the president yesterday is expected to remain in effect for at least the immediate future.

A very large area of the Los Angeles basin—the immediate blast and radiation zone in Long Beach and many tens of square miles in Los Angeles and Orange County in the heavy fallout zone—has suffered severe damage and is clearly going to be inaccessible for a substantial period. Rescue operations inside this zone will be minimal for weeks.

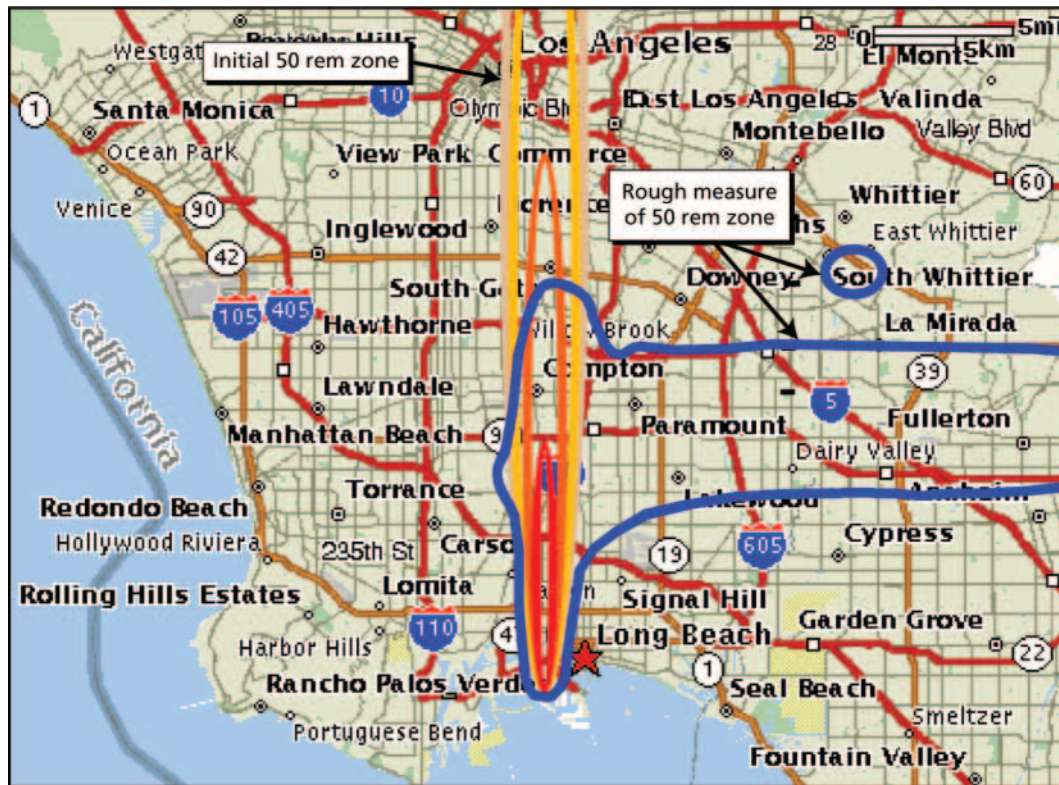
The Federal Radiological Monitoring and Assessment Center (FRMAC) has taken over the lead in coordinating the characterization of the fallout areas. FRMAC is increasingly confident that it has characterized the rough outlines of the fallout zone within which people must be evacuated immediately where the exposure in the first 24 hours is 50 rem or greater (see Figure A.8). This area encompasses about 300,000–400,000 people during business hours and features a hotspot north of the main fallout zone. FRMAC has provided these evaluations to federal and state officials.

Based on FRMAC's estimates, as many as 60,000 people have died or will eventually die in the coming weeks and months of radiation effects or direct injuries from the explosion, even with treatment. Roughly 8,000 people will have severe burns and will require hospitalization, although at least half of them may have absorbed lethal radiation doses and will die after a few weeks. At least half of these victims are school children. Another 100,000–150,000 may have been exposed to enough radiation to get sick (> 100 rem) but will recover even without treatment. They are likely, however, to experience for years the lingering chronic effects from their exposure. Further, there is the prospect that hundreds of thousands of persons will swamp all medical care facilities believing, in many cases erroneously, that they have received serious radiation poisoning.

Of special concern to the insurance industry, it is not known what fraction of the injuries or deaths occurred in workplace environments. One concern of community officials is that the fallout zone covers mainly low-income areas, while the fallout has contaminated most of the medical centers and clinics that this population would have turned to.

A larger region—the contours of which are slowly emerging (see below)—has suffered fallout levels that are less deadly but still in excess of EPA [Environmental Protection Agency] and NRC [Nuclear Regulatory Commission] standards. Some rescue and repair operations may be possible in these regions, particularly after the first few days. The spontaneous evacuation of these areas, as well as areas far from the fallout zone, continues apace.

Figure A.8
Fallout Area Estimated from Measurements, Compared with Initial Models



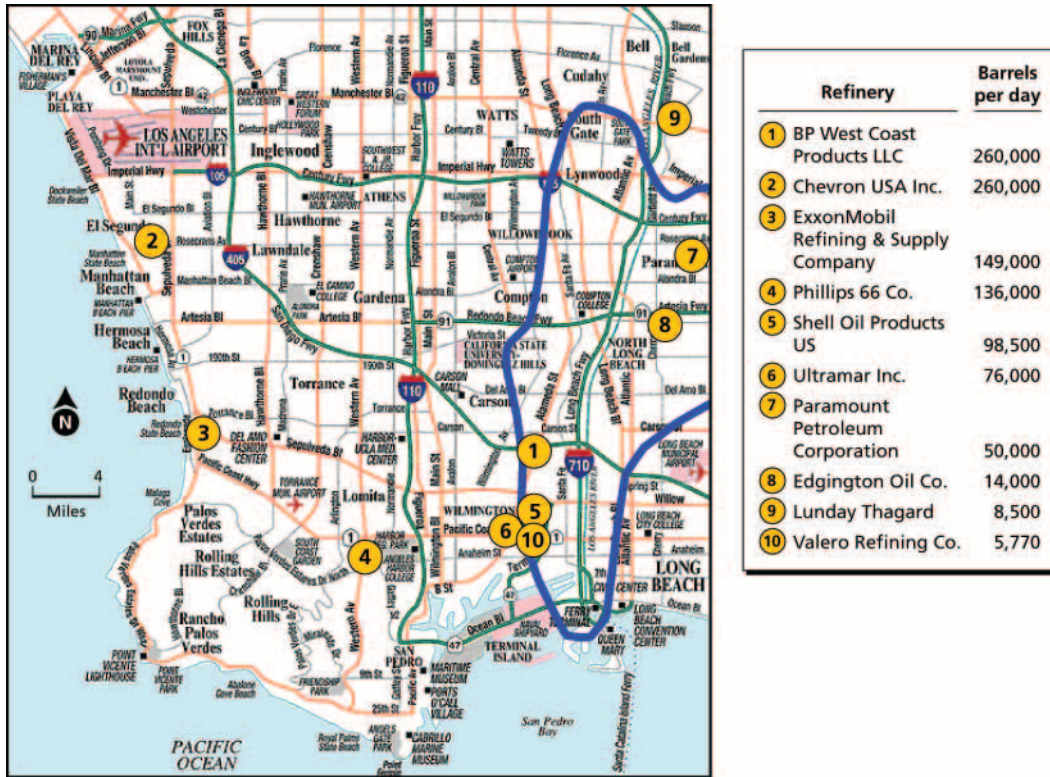
SOURCE: Map and content © 2006 by MapQuest, Inc. Used with permission.

RAND TR391-A.8

A still larger region also has fallout radiation levels well in excess of permissible levels; evacuation of residents in those areas—many of whom have or are in the process of evacuating spontaneously—on a more systematic basis is probably advisable. Based on the FRMAC's initial measurements, state and local officials realize that the fallout has likely seriously contaminated 5 of the 10 refineries in the L.A. basin, including one of the two largest (see Figure A.9). The loss of those refineries will remove 40% of L.A.'s refinery capacity for months or even years. This will have dramatic effects outside the city, too, as L.A. supplies all of southern California, Nevada, and much of Arizona by pipeline. No pipelines flow into the region.

Discussions have already begun by local political leaders about how to handle the recovery phase in the heavily affected areas, centering on what radiation levels are acceptable for permitting populations back—in part to alleviate the mounting evacuation and resettlement problem for refugees from the region (see below).

Figure A.9
Refineries Affected by Fallout



SOURCE: Map and content © 2006 by MapQuest, Inc. and © 2000 City Maps. Used with permission.
RAND TR391-A.9

In Other Parts of the L.A. Basin—0600 PST

Power has already been restored to some parts of the L.A. basin outside the blast zone. Communications, which were only moderately damaged outside the Long Beach area but suffered from overloads elsewhere, are expected to slowly return in almost all other parts of the region.

Water pressure in large areas of the L.A. basin is still very low because of ruptured pipes in the blast zone.

Roads and highways throughout the region remain snarled and impassible. Officials are slowly starting to clear key routes outside of the fallout zone by using National Guard and Marine [Corps] armored recovery vehicles and bulldozers to push vehicles out of the way. Only these units are capable of working in a contaminated environment.

More distant from the blast zone and outside of the zone of predicted heavy fallout, local and state governments are using both police and private contractors to remove abandoned vehicles from the major roadways. Emergency responders are still having serious trouble getting near the zone of maximum damage and fallout.

L.A. Basin—0600 PST

While authorities struggle to regain control of the situation in the area of damage in the L.A. basin, another acute problem has arisen in the spontaneous evacuation of residents throughout the L.A. region. While the inability to garner high confidence predictions of the area of dangerous fallout has clearly spurred some of this evacuation, in many other cases even a highly defined area of danger would probably not have kept some people in their residences.

Local and state authorities provide both Sacramento and Washington D.C. with a “guess-timate” that more than 6 million people have left their homes and are trying to leave the L.A. basin. As time passes, more of them succeed, despite the jammed roads.

New York City—0600 PST (0900 EST)

The president closes all markets until further notice.

Sacramento—0630 PST

The governor of California decides to facilitate the evacuation of citizens who want to leave the L.A. region. Further, he appeals for federal assistance to provide temporary shelter for 6 million persons, many who are now encamped in locations along the main roadways on the other side of the L.A. basin mountains. Early local government and private business estimates suggest that the impact on commerce and the delivery of services of all kinds in the L.A. region—and the overall impact on the economy—is obviously going to be extraordinary.

The governor’s staff is aware that the combination of the large exodus and the heavy contamination of oil refineries and storage tanks near the harbor is producing an acute gasoline shortage. The system to provide gas and diesel to consumers is in the process of being sucked dry. In response to this situation the governor issues Emergency Order No. 6, empowering the California Energy Commission to “hold control of petroleum stocks” as needed to ensure health, safety, and welfare of the public.

On this basis, state officials have directed oil companies to make a concerted effort to keep gas stations along evacuation routes supplied. In addition, the state has issued voluntary petroleum management guidelines for consumers in an effort to reduce demand. At the same time, the state has purchased enough gasoline and diesel to keep its emergency response vehicles operating for one week. This is a controversial action, as the state has insisted on paying pre-attack prices for the products, but the companies insist its value is much greater.

Gasoline prices in Los Angeles have gone crazy, but the price spike is not limited to L.A. alone. Prices in San Diego quickly shoot up owing to its dependence on gas from the L.A. pipeline. Prices have also risen in neighboring states. The governor has appealed publicly to the patriotism of gasoline retailers to not gouge consumers.

State energy officials request assistance from the federal government in getting emergency gas to the state. In addition, Nevada and Arizona state officials have expressed concerns about the disruption in supply to their states and have raised concerns with the federal government.

Washington D.C.—0645 PST (0945 EST)

The Critical Infrastructure Coordinator is now on the ground as part of the Infrastructure Coordination Division’s efforts to support the Joint Federal Office being established in Los Angeles.

The DHS Private Sector Office, as part of its role on the IIMG, has activated the Donations Management Website to facilitate the provision of goods and services to the affected area.

Sacramento—0645 PST (0945 EST)

The magnitude of the problem created by the evacuation of the L.A. basin is becoming clearer as overnight assessments are used to generate a map (see Figure A.10) identifying the locations where evacuees are now clustered.

Figure A.10
Locations of Evacuees



SOURCE: Map and content © 2006 by MapQuest, Inc. Used with permission.
[NOTES: magenta = 1 million evacuees; red = 250,000 evacuees; orange = 25,000 evacuees; yellow = 2,500 evacuees.]

RAND TR391-A.10

Washington D.C.—0700 PST (1000 EST)

The enormity of the social and economic catastrophe is finally becoming clear in Washington. The humanitarian crisis and recovery needs are beyond comprehension, orders of magnitude greater than the largest hurricanes or earthquakes experienced in modern times. The long-term consequences of the loss of the Long Beach port, which handles 25 percent of container traffic into the United States and 70 percent of the traffic from Asia, the semipermanent evacuation of a significant fraction of the L.A. area, and the cascading effects on the national economy will be huge. The federal government is committed to both solving the humanitarian crisis and minimizing the effects of the attack on the economy to the greatest extent possible, while providing security against future attacks.

Key elements of the federal responsibility for the economic impacts from the explosion are addressed by the Terrorism Risk Insurance Act (TRIA), which was extended for another year in January 2005. At this point, the key outstanding issue for TRIA is whether the explosion was a foreign terrorist attack. No responsibility has been claimed; though there are suspicions that Al Qaeda is responsible. In light of this uncertainty, there have been no public statements regarding the applicability of the TRIA provisions.

While the magnitude of the economic damage is unknown, it is clear that it will be staggering, causing the Secretaries of Treasury and DHS to convene an ad hoc insurance and property advisory task force to recommend immediate actions to mitigate the losses and impacts. At 6 pm the group is convened. The group is provided with an update on federal response actions currently taking place in the Los Angeles basin and draft memoranda that summarize current and projected problems.

Participants in the group are asked to focus on the broader questions that DHS is asking. Federal, state, and local responders are handling the immediate consequences of the event.

Washington, D.C.—0930 PST (1230 EST)

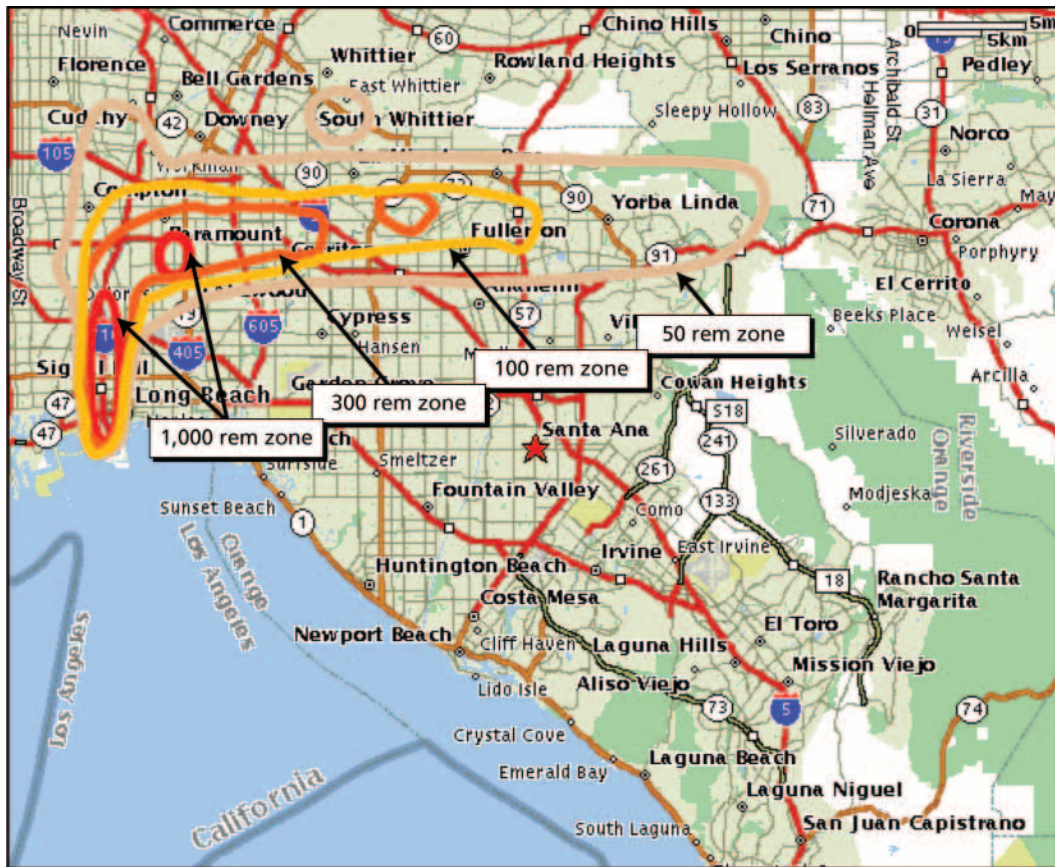
The chairman of the Federal Reserve, after an emergency meeting, announces that the Federal Reserve will take all action necessary to ensure [that] the United States economy has sufficient liquidity to soften the economic shock of the L.A. disaster.

(Step 2) March 17, 2005

Over the last two days, most of the critical infrastructure essential to survival of the population outside of the fallout zone (water, sanitation, and electricity) has been restored except within the blast zone around Long Beach harbor.

The fallout zone has been carefully mapped by National Laboratory teams, including local hotspots where radiation levels are surprisingly high (see Figure A.11). The electric utilities have begun sending workers into the cooler parts of the fallout zone for short periods of time to reset switches that affect delivery of electricity in the broader L.A. basin.

Figure A.11
Detailed Measurements of Fallout Zone for Cumulative Exposure at 72 Hours



SOURCE: Map and content © 2006 by MapQuest, Inc. Used with permission.

RAND TR391-A.11

The zone that will require long-term relocation of people and businesses is 450 km², according to the EPA's relocation guidelines of 2 rem in the first year (see Figure A.12). This area is home to an estimated 2 million people. (The standards for what is safe enough to live in will continue to be the subject of intense, emotional debate for years.) Those people must be moved within the next few days and may not be able to take most of their possessions because of contamination.

The area within the fallout zone where people can safely return to work and be exposed to only 5 rem per year (the Nuclear Regulatory Commission's standard for maximum exposure for nuclear workers) is growing steadily, but still large areas remain unsafe. Figure A.12 shows [that] an area of about 250 km² will remain inaccessible for businesses even one year after the event.

Figure A.12
Detailed Measurements at 72 Hours of Relocation and Future Work Areas of Fallout Zone



SOURCE: Map and content © 2006 by MapQuest, Inc. Used with permission.

[NOTE: PAG = Protective Action Guidelines.]

RAND TR391-A.12

Community officials are beginning to realize the magnitude of the fallout zone on low-income populations. The affected area is home to communities that speak languages other than English at home that include Spanish and many different Asian languages. Numerous hospitals and clinics that low-income people turn to for medical treatment have been contaminated and will be lost for years. This population continues to arrive at hospitals throughout the area for assistance and shelter; unable to flee far from the fallout zone except by publicly provided mass transit.

A huge refugee problem has emerged. In addition to those who are displaced from the fallout zone, at least 4 million more people have self-evacuated out of fear of the fallout and other attacks, although some, unable to leave the area due to impassable roads or lack of transportation have remained in the L.A. region outside the fallout zone, staying with friends or squatting in parks, playing fields, or on beaches. Red Cross efforts to set up shelters are outstripped by demand.

Looting and crime have become major problems in the L.A. area. Desperate people seeking food cause some crime, but thugs looting abandoned residences and businesses and preying on refugees cause the most crime. Shootings have become commonplace.

The victims of the incident overwhelm hospitals. Shortages of personnel and supplies are reaching desperate levels. Mobile military medical units are helping to relieve the overload, but it is not sufficient, and state and federal officials are using available large spaces like stadiums and gyms within a 50-mile radius as clinics.

Public health concerns stemming from the refugee situation and potential for infectious disease outbreaks loom large. The number of dead and dying overwhelm mortuary capabilities and ongoing concerns about contamination and recontamination remain unresolved. Concerns arise about the availability of non-contaminated food and water.

All U.S. ports remain closed to imports as federal officials complete their inspection of cargo containers in the United States and determine how to screen incoming cargo for weapons. Trains carrying containers also remain in their remote locations.

Washington, D.C.—0900 PST (1200 EST)

Against the advice of the Secret Service, the president returned from Omaha to Washington, D.C., during the early morning. In the White House he receives a status report of the displaced persons who have left the L.A. basin area. Based upon aerial observation and local reporting, the DHS secretary estimates that more than 4 million persons are displaced outside of the L.A. basin. He highlights the following facts:

- More than 300,000 people are strung out along the major interstates to the north of the San Gabriel Mountains. Most people are out of gas and critically low on water and food.
- Another 2 million are clustered in ten different locations that include Val Verde Park, Santa Clarita, Vincent, Palmdale, Lancaster, Victorville, and Barstow.
- Approximately another one million are strung along the north and south coasts of the L.A. basin with heavy concentrations in Oxnard, Laguna Beach, and San Juan Capistrano.
- Several hundred thousand have moved farther to the north and south to find emergency housing.
- It is estimated that more than a million persons have left the state of California and have arrived in Reno, Las Vegas, and Phoenix.
- In all communities, space for displaced persons has been provided by the opening up of hotels, schools, and warehouses—these facilities are overwhelmed, and many are living in their vehicles and/or camping in various public parks and open private property.
- An estimated 1 million people have returned to areas outside of the 50-mile per year zone.
- More than 30,000 regular, reserve, and National Guard troops are deployed in the L.A. basin, with another 20,000 expected to arrive in the next 24 hours.

When asked by the president, the DHS secretary, with the concurrence of the DOE secretary, suggests that more than 2 million persons might be displaced from the zone of high contamination for a year or more.

In response to the scale of emergency and further requests for assistance by the governor of California, the president orders the federalization of 200,000 National Guard troops in other states to be deployed on an “as needed basis.” A high priority is given to the mobilization of all MP units that are now being airlifted to the several military airfields outside of the L.A. basin to provide additional police protection to the displaced persons and those areas deemed fit for habitation inside the L.A. metropolitan zone.

In addition a Marine [Corps] regiment from Camp Pendleton (reinforced with combat engineering and medical support) is scheduled to arrive on the morning of the 16th with an Army unit from Ft. Lewis, Washington, also on its way to the region to arrive on the 17th. Additional military units will soon begin flowing via airlift to operating civilian airfields in the region.

Los Angeles International, John Wayne International, and Ontario International airports are major hubs for the relief airlift and remain closed to commercial air traffic. Santa Monica and several other city and private airfields have been requisitioned for military and emergency airlift use. An amphibious ready group, including the helicopter landing dock USS Pelileu, plans to arrive off the L.A. coast by March 18. Two landing ship docks, filled with emergency supplies, will operate off shore to provide a quick reaction assistance capability. Most important is the use of the Pelileu as an offshore base for helicopter operations. An additional amphibious ready group is scheduled to arrive within another five days with additional helicopter assets. A naval hospital ship is also deployed to provide additional support.

Sacramento—0930 PST (1130 EST)

The governor received the following status reports of the emergency cleanup work under way:

- Interstate 5 between downtown Los Angeles and Santa Ana have finally been cleared of all abandoned and contaminated vehicles. Several major secondary roads, such as route 57 between Fullerton and Brea and Route 1, remain impassable.
- Interstate 710 between the port and Route 91 remains closed. I-405 remains severed between I-110 and Seal Beach. Several bridges near the port have been displaced by the Long Beach blast and need further emergency repair.
- The chief of staff for the California National Guard noted that work on I-710, I-405, and several other routes has been slowed by intense radiation. The military’s specialized engineering vehicles will have to wait for at least 2–3 days before they can safely operate in the “hot zone.”
- Outside of the 200-rem zone, private contractors have all but cleared all major highways of abandoned vehicles.
- As per agreement, the remains of those 14,000 killed at the blast site, heavy fallout locations, and from the emergency road clearing operations have been buried in two mass graves north of route 22 near Garden Grove. Emergency morgues are now able to process about 20,000 persons who had died of radiation poisoning over the last 72 hours. Most

will have to be buried at additional mass graves. Senior state public health officials have made an estimate that an additional 50,000 seriously ill with radiation poisoning will likely die at a declining rate over the next ten days.

After considerable debate, the governor decides that the zone identified as the 300-rem exposure zone will remain off limits to all other than emergency, police, and military personnel (see Figure A.11).

A separate preliminary estimate indicates that California will have to consider the social and economic consequences of temporarily housing more than a million persons in locations outside of the L.A. basin for at least a year, the “equivalent of creating a city the size of Las Vegas overnight.”

Washington, D.C.—1030 PST (1230 EST)

During a reconvened cabinet meeting, the secretaries of Energy, Transportation, the Treasury, and Commerce provide additional information about the near-term impact of the destruction of the port of Long Beach on the U.S. economy:

- The seven L.A. refineries remain closed by fallout. Preliminary estimates suggest that several might be reopened within a month or two. At this time, the seven refineries account for 24 percent of the gasoline and 18 percent of the jet fuel supplying the United States. Las Vegas, Phoenix, and San Diego face major energy shortages within a matter of days.
- Gasoline prices in southern California have more than tripled, and in other parts of the West Coast to the west of the Rockies they have risen by 30 percent.
- The nation’s freight system is in disarray. The Port of Los Angeles (POLA) and the Port of Long Beach (POLB) handle 70 percent of the container traffic for the West Coast. Other West Coast ports have additional capacity. If the ports of Seattle, Tacoma, and Oakland increase their operations to two eight-hour shifts, they can make up just over 80 percent of the loss of West Coast capacity. The DOT secretary notes that this is an idealized number, since the total throughput will be less due to radically enhanced surveillance requirements and a major alteration of the land transportation network.
- The secretaries of the Treasury and Commerce note that local and national business activity will be severely constrained by the fact that the L.A. basin will suffer a massive uninsured property loss. Further, the solvency of many companies including several banks and thousands of small businesses may be called into question as creditors consider the full extent of their losses. Credit for regular business transactions may dry up in the face of the perceived and actual risk that many local businesses face bankruptcy. Credit may also tighten for businesses around the nation due to banker’s fears that similar attacks may occur in other major cities.
- The secretary of the Treasury concluded by noting that the chairman of the Federal Reserve will take every effort to ensure local and national liquidity.

North of the San Gabriel Mountains—1230 PST (1530 EST)

There has been a large number of incidents of looting and shootings, especially in several of the emergency camps that have sprung up north of the San Gabriel Mountains. The military has been tasked to provide law and order. As yet, it does not have enough of a presence to stop all incidents.

Army and National Guard units are continuing to pick up refugees found along the major interstate system. Other refugee sites and several small communities inundated with people are now being supplied by airdrop because the roads in many areas remain impassable.

Washington D.C.—1300 PST (1600 EST)

The secretaries of the Treasury and DHS request that the ad hoc insurance and property advisory task force be reconvened to assess and make recommendations on the key issues and problems that need to be addressed at this point in time.

At 1400 EST the groups are convened and provided with an update on the status of response actions in the Los Angeles basin and draft memoranda that identify some of the issues of concern at this time at the federal level.

Excerpts from the Decisionmaking Game Exercises Used with Leaders of the Insurance and Real Estate Community

This appendix presents the decisionmaking protocols presented at three different steps in the strategic games. The time in the scenario description is noted in each step. The participants knew the scenario only up to this point, and they discussed their answers to the questions in a working group format. The discussions were recorded and synthesized at the end of the game.

Scenario Time: March 15 12:30 EST

Step One Instructions: How to Proceed

1. You will have 60 minutes to complete your deliberations on Step One.
2. You will participate in a meeting of an *ad hoc* Insurance and Property task force comprised of leaders from the business community. The meeting has been convened to provide advice and tasking to the Secretaries of Treasury and Homeland Security on the top-level government response to the crisis in Long Beach.
It is recognized that the group's recommended actions may require Presidential approval, though some could be aimed at state and local officials.
3. The group's task is to attempt to reach consensus on:
 - (i) Government actions to address the impacts, either on a regional or national scale,
 - (ii) A conceptual strategy appropriate to the situation,
 - (iii) The key issues that need to be addressed at this time in light of this situation, and
 - (iv) Any early insights on how some of these key issues might be approached.
A draft memorandum for this purpose has been prepared by staff and is provided on the following pages.
4. The group leader will begin the discussion of the memorandum by asking the members of the group to give their individual perspectives (their "take") on the overall situation as presented, focusing on the basic challenges and possible issue priorities.
5. The group leader will then move quickly to the draft memorandum and attempt to find a consensus within the group on an action plan on the issues and problems presented and other issues or problems that may emerge in the deliberations.
6. The group leader will summarize the group's deliberations and its recommended actions in the Step One plenary session.

Step One

Memorandum for the Secretaries of Treasury and DHS

15 March 2005

MEMORANDUM FOR: The Secretaries of Treasury and Homeland Security
FROM: *ad hoc* “Insurance and Property” Task Force
SUBJECT: Emerging Issues in the Wake of the Nuclear Attack on the Port at Long Beach

Overview

The Port of Long Beach was ground zero of a 10-kiloton nuclear detonation. There is a crater approximately 300 feet in diameter and 60 feet deep in the middle of what used to be Pier E. Containers have been thrown in every direction, some landing more than a mile away. The radioactivity levels from fallout on the immediate area are very high. An oil slick has spread throughout the port facilities and ignited, further complicating any rescue or recovery operations.

The Port of Los Angeles absorbed much less damage but is closed and will remain so for at least several months, pending a thorough damage assessment, removal of debris from the channels, and decontamination activities.

These port facilities are responsible for a staggering share of the nation’s imports. As a simple indicator of the nationwide scope of the effect of this catastrophe, consider that approximately 60% of the imports used in Chicago come through the ports of Los Angeles. The value of the goods moving through the ports approaches \$200 billion. Approximately 70% of the container traffic on the West Coast of the United States moves through these facilities. The loss of this capacity for any length of time imposes a major blow to the economy of not only California, but of the entire United States.

In addition to the above factors, the shift from “just in time” logistics to “exactly in time” logistics—which increases efficiency by decreasing stockpiles of raw materials at industrial facilities of all sorts—means that the ability of manufacturers to “ride out” temporary shortages of material is greatly diminished. The government and industry must therefore cooperate in order to help to mitigate the damage that will occur throughout the national economy.

Further complicating the situation is the closure of several key petroleum refineries and facilities, which lie within the fallout zone. The combination of the large exodus and the destruction of oil refineries and storage tanks near the harbor is producing an acute gasoline shortage.

A recommended set of such issues follows.

National Repercussions

It is clear that the damage to the country extends far beyond LA. With the closure of all ports, the declaration of Code Red on the west coast and Code Orange for the rest of the country, the economic ripple effects are already being felt and will soon create major economic and other hardships. The unprecedented scope of the disaster makes estimating its impacts with any degree of precision impossible, yet it must be done because for the President to make informed security policy choices, [he] will have to weigh the benefits of increased security against the costs.

1. What are the greatest economic concerns for the nation at this point? What economic issues should be the focus of immediate policy action by the Secretaries and President?
 - _____

 - _____

2. Should the President or Secretaries make public statements regarding TRIA or insurance compensation? Sarbanes-Oxley? Other legislative/regulatory issues?
 - _____

 - _____

 - _____

3. At this point, what types of information do the Secretaries need to formulate economic response policies? If the information is not readily available, what steps should be taken to obtain it?
 - _____

 - _____

4. Are there actions the government can take to limit economic damage at this point?

- _____

- _____

Private Sector Issues

1. We understand that the President has indicated privately that, if at all possible, he wants all U.S. ports other than LA/Long Beach to be open *no later than six days from now* in order to show that the country can be operating again after this kind of blow “within a week”—and that to this end he has asked for a list of the critical issues that will need to be addressed to meet such a goal.

- _____

- _____

- _____

2. What types of information will be needed by the Insurance and Property Communities at this point? If the information is not readily available, what steps will be needed to acquire it?

- _____

- _____

- _____

Scenario Time: March 17, 1600 EST

Step Two Instructions: How to Proceed

1. You will have 60 minutes to complete your deliberations on Step Two.
2. You will participate in a meeting of an *ad hoc* Insurance and Property task force comprised of leaders from the business community. The meeting has been convened to provide advice and tasking to the Secretaries of Treasury and Homeland Security on the top-level government response to the crisis in Long Beach.

It is recognized that the group's recommended actions may require Presidential approval, though some could be aimed at state and local officials.
3. The group's task is to attempt to reach consensus on:
 - (i) Government actions to address the impacts, either on a regional or national scale,
 - (ii) A conceptual strategy appropriate to the situation,
 - (iii) The key issues that need to be addressed at this time in light of this situation, and
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A draft memorandum for this purpose has been prepared by staff and is provided on the following pages.
4. The group leader will begin the discussion of the memorandum by asking the members of the group to give their individual perspectives (their "take") on the overall situation as presented, focusing on the basic challenges and possible issue priorities.
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6. The group leader will summarize the group's deliberations and its recommended actions in the Step One plenary session.

Memorandum for the Secretaries of Homeland Security and Treasury

17 March 2005

MEMORANDUM FOR: **The Secretary of Treasury**
 The Secretary of Homeland Security
FROM: *ad hoc* **“Insurance and Property” Task Force**
SUBJECT: **Emerging Issues in the Wake of the Nuclear Attack on the Port**
 at Long Beach

Overview

As we enter the fourth day (72 hours) after the nuclear explosion in Long Beach, the effects are clearly substantially greater than were estimated at 24 hours. Unlike previous natural disasters or terrorist attacks, it has become clear that the dislocations from this event will continue for years in some dimensions. Currently, there are approximately 5–6 million people displaced and many square miles of LA will be uninhabitable for the foreseeable future. It is likely that 2–3 million people will be permanently displaced because of the Port of Long Beach event.

The number of burn patients has doubled from the 24-hour estimate: from 4,000 to 8,000 burn victims. A large fraction of these victims have a moderate level of severity. With appropriate treatment, long-term survival for these moderate burn victims is possible. Although palliative burn treatment for moderate victims is easy (rest, hydration, clean bandages), demand outstrips supply. Reallocating burn patients to facilities outside the region and state will be required, as soon as possible.

Because numbers of long-term displaced people are increasing at this time, it is getting difficult for established shelters to handle the volume of people at current resources. The Red Cross is revisiting its standard operating procedures for distributed shelters and thinking about establishing larger refugee camps to meet demands. As a result the federal government has initiated steps to requisition all available large facilities that could be used for shelter (hotels, conference facilities, dormitories, etc.)

At 72 hours, crowd control at the decontamination facilities is a huge problem. There is looting in the contaminated area. Nerves are frayed and there is random violence. During this period, “clean” people have been recontaminated by eating radioactive food, traveling through the plume area or using radioactive cars. Hospitals and makeshift facilities are overwhelmed with radioactive people and the “worried well.” Authorities are finding out that it is impossible to track “clean” people from contaminated people. The demand for decontamination resources is outstripping the supply and need for reoccurring decontamination.

Since the 24-hour mark, 2500 hospital beds have been removed from LA and Orange Counties because of the drifting radioactive plume. There are no more hospital beds for other injured persons in LA and Orange Counties. Under current FEMA [Federal Emergency Management Administration] policy, patient transfers within a state are not compensated by FEMA. Emergency Medical Services cannot access retail stocks of medical supplies, which are in short supply. Makeshift medical facilities are worrying about how they will resupply and who will pay for it. Local Emergency Medical services have contacted the Centers for Disease

Control [and Prevention]'s Strategic National Stockpile (SNS) for medical supplies, but the SNS does not have stocks of needed burn supplies and equipment. CDC is trying to resupply the affected area through contacting vendors throughout the U.S.

The nation's freight transit system is in a shambles. Although commercial airlines were allowed to resume service after only one day, the decision to isolate and clear all containerized cargo has completely disrupted the flow of goods throughout the United States. While very good progress has been made in clearing and releasing containers originating from "safe" ports, the need to replan and reroute hundreds of thousands of containers presents a daunting set of logistical problems. Time-sensitive cargos such as foodstuffs are being expedited, but there is conflicting guidance, and those responsible for inspecting and releasing cargo are (understandably) risk-averse. Many shipments of industrial materials have been delayed, and these delays are causing serious problems for critical facilities such as water treatment plants.

Meanwhile, attempts are being made to send refined gasoline into the affected region in order to facilitate the evacuation of refugees from the area. However, commercial gasoline inventories have shrunk throughout the nation, either as a result of topping off and hoarding or by people from other major population areas leaving town and driving to less-populated areas; campsites throughout the nation report being filled to capacity, even in northern states. The price of gasoline in the southwestern United States has tripled, and the rest of the country has seen a 30 percent increase in price.

There is a need to address how the government and private sector can cooperate to adjust to and recover from the loss of petroleum refining capacity, and to minimize the harm to regional and national petroleum markets and economy, caused by the attack on Long Beach. The Defense Production Act (DPA), in addition to the authority it provides for allocation and contract priority ratings, allows for "voluntary agreements" and "plans of action" by private sector entities to "help provide for the defense of the United States through the development of preparedness programs and the expansion of productive capacity and supply beyond levels needed to meet essential civilian demand in the United States." The law also accords an anti-trust defense and a breach of contract defense to the participants who carry out an approved voluntary agreement or plan of action.

The voluntary agreement allows industry to collaborate in planning its recommended response to an emergency; the voluntary agreement also can afford legal protections to desired forms of collaborative implementation, such as the sharing of resources and costs, that might be impracticable to achieve through government allocation orders.

The loss of the Port of Los Angeles (POLA) and the Port of Long Beach (POLB) represents a loss of the largest port on the West Coast, handling 69% of container traffic. There is spare capacity at other ports on the west coast, but not nearly enough to counter the massive loss. If the ports of Seattle, Tacoma, and Oakland can increase operations to 16-hour days and have shippers share berth facilities, and if other ports maintain their current level of shipments, then the West Coast can accommodate 83 percent of the West Coast's pre-attack capacity. Some ports report that some of their employees have called to say that they have been forbidden by their families from returning to work until "things are safe." No one has yet ascertained exactly what that means.

National Repercussions

It is clear that the damage to the country extends far beyond LA. With the closure of all ports, the declaration of Code Red on the West Coast and Code Orange for the rest of the country, the economic ripple effects are already being felt and will soon create major economic and other hardships. The unprecedented scope of the disaster makes estimating its impacts with any degree of precision impossible, yet it must be done because for the President to make informed security policy choices, [he] will have to weigh the benefits of increased security against the costs.

1. What are the greatest economic concerns for the nation at this point? What economic issues should be the focus of immediate policy action by the Secretaries and President?
 - _____

 - _____

2. Should the President or Secretaries make public statements regarding TRIA or insurance compensation? Sarbanes-Oxley? Other legislative/regulatory issues?
 - _____

 - _____

 - _____

3. At this point, what types of information do the Secretaries need to formulate economic response policies? If the information is not readily available, what steps should be taken to obtain it?
 - _____

 - _____

4. Are there actions the government can take to limit economic damage at this point?

- _____

- _____

Private Sector Issues

1. We understand that the President has indicated privately that, if at all possible, he wants all U.S. ports other than LA/Long Beach to be open *no later than six days from now* in order to show that the country can be operating again after this kind of blow “within a week”—and that to this end he has asked for a list of the critical issues that will need to be addressed to meet such a goal.

- _____

- _____

- _____

2. What types of information will be needed by the Insurance and Property Communities at this point? If the information is not readily available, what steps will be needed to acquire it?

- _____

- _____

Injuries and Insurance Coverage

Emergency medical care and surgery is occurring on an unprecedented scale throughout Southern California, most of it uncompensated and without formal documentation to facilitate reimbursement by insurance. Without a mechanism for future payments, the solvency of medical establishments throughout the region is at risk, raising the possibility that doctors and hospitals may stop providing urgently needed services.

What actions should the Secretaries of Treasury and DHS take on this issue?

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- ---

Scenario Time: End of the Game

Step Three Instructions: How to Proceed

1. You will have sixty minutes to complete your deliberations on Step Three.
2. You will be a participant in a November 2004 meeting of a newly formed private sector Insurance and Property Task Force, charged to prioritize a framework for government policies addressed to insurance and compensation for victims of terrorism. You will be working with a draft framework based on issues to be addressed in the upcoming debate regarding the extension of the Terrorism Risk Insurance Act.
3. To facilitate strategy development, you will be encouraged to consider issues addressed in the Step 1 and 2 discussions, including:
 - The insurability of catastrophic terrorist attacks;
 - Appropriate public policy framework(s) for the risks of terrorism; and
 - Strategic opportunities to reduce the economic impacts of a major terrorist attack on insurers and property owners, and the U.S. economy writ large.
4. The group's principal task is to reach consensus on
 - a) A set of questions regarding the risks of terrorism and the feasibility of compensation schemes for different types of attacks.
 - b) A balanced action plan, drawing on a menu of strategic options.
5. The group leader will begin by asking members for brief individual perspectives, and then moving to a discussion of the draft memo.
6. The group leader will summarize the group's deliberations and its recommendations in the Step Three plenary session.

7 October 2004

MEMORANDUM FOR: Secretary of Homeland Security
 Secretary of Treasury

FROM: Insurance and Property Task Force

SUBJECT: Compensation and Insurance Framework for Victims of Terrorism

Overview

This memo prioritizes a framework for the federal and private sector approach for compensating losses from terrorist attacks.

The memo responds to tasking from the Secretaries of Treasury and Homeland Security, motivated by the following developments.

1. The Terrorism Risk Insurance Act (TRIA) is set to expire at the end of 2004, triggering a new debate on the nature of the federal-private partnership to address the risks of terrorism.
2. Detailed analyses of terrorist attack scenarios reveal the potential for truly catastrophic impacts that would greatly exceed the government's or private sector's capability for compensation.
3. There is continued uncertainty regarding the measures of risk for different terrorist attack scenarios.

Defining a Framework

With this background, the Insurance and Property Task Force defines a policy framework through its response to the following questions.

1. Should government policies on terrorism be tailored to different insurance market segments or types of attack?

Recommended course of action: _____

2. Should national security considerations factor into policies on insurance and compensation systems? In what fashion?

Recommended course of action: _____

3. Can individuals and businesses properly evaluate the risks of terrorism at this time? What private sector actions would improve the prospects for obtaining better risk information?

Recommended course of action: _____

4. What is the capability for private insurance markets to provide terrorism insurance at commercially reasonable rates?

Recommended course of action: _____

Illustrative Strategic Options

Considering the framework issues above, we have identified three illustrative strategic options for government policy on insuring and compensating victims of terrorist attacks. The options, with examples, are presented below:

1. Private market solutions with limited government oversight
 - Catastrophe bonds
 - Pre-funded, tax-free catastrophe reserves
 - Voluntary pool for workers' compensation.
2. Government structures or finances insurance or reinsurance for terrorism losses
 - TRIA remains in place
 - TRIA is expanded
 - TRIA is rolled back and replaced with an industry pool
 - Mandatory government-sponsored insurance.
3. Government provides compensation for terrorism losses
 - Government-provided compensation with partial recovery
 - Government-provided compensation with full or nearly full recovery.

Recommended course of action: _____

