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April 25, 2002

Director, Federal Bureau of Investigation
Homeland Security Advisory System, Room 7222
935 Pennsylvania Avenue, NW
Washington, DC 20535

The Homeland Security Advisory System (HSAS) is an excellent first step forward in communicating potential threat from terrorist acts. However there are several aspects of HSAS that need improvement. The most significant is to separate probability and risk in defining threat.

There have been decades of experience and research on communicating potential and developing threats, particularly from natural disasters and technological accidents and for events with low to high probability of occurrence. Social scientists have played a major role here. John Marburger, the President's Science Advisor, just said on April 11 "We are not yet systematically including the social scientists in the mobilization for the war on terrorism, and this needs to be done." The physical scientists also play a major role here since they have been developing most of the information.

The Partnership for Public Warning (PPW) has offered to the Office of Homeland Security and the Department of Justice (DOJ) to bring together for several days approximately 30 of the most experienced national experts on issuing warnings and those who have studied how warnings are received and acted upon. This group would review HSAS, describe issues of concern, and suggest improvements and additions to meet the intended purpose. We are still convinced that DOJ would find such a review valuable before final release of the system. We also believe that applying existing experience to the final design of HSAS would enhance its effectiveness and its acceptability to the American people and would reduce negative political consequences.

This letter is being submitted to meet the April 25 deadline for input and does not benefit from the collective wisdom of such a group of experts, although many have reviewed it. The issues outlined here are the obvious ones, but this letter should not be construed to include all of the issues that such a review could help clarify.

The intent of the Homeland Security Advisory System (HSAS) is "to create a common vocabulary, context, and structure for an ongoing national discussion with Federal, State and local authorities, private sector industries, and the people of the United States about the nature of the threats that confront the homeland and the appropriate measures that should be taken in response."

Warning, alerting, notifying the public with the intent to induce them to take certain actions is a difficult problem that has been the basis for a great deal of research. This is especially true for terrorism and other situations where advance information is often ambiguous and inaction may lead to high losses.

The need for HSAS is clear. Extensive experience shows that people do understand warnings better and are better primed to take appropriate action when, well before the warning, they have been educated about the hazard and have developed action plans. Action plans should be developed incrementally depending on the anticipated level of the threat. Threat-level scales become a basis for responders to think what specific actions would be appropriate in which cases. Threat-level scales are also a way of requiring those with disparate information about potential threats to sort that information into a specific number of bins and to then decide which single bin is most important. In other words, threat-level scales provide a way for the people issuing the threat advisory to express the threat in terms that the responders have agreed in advance should lead to certain actions being taken. The scale is used to communicate the evidence succinctly so that the responder can quickly comprehend the threat and know which plan to activate.

When we intend to communicate in order to cause people and their organizations to take appropriate action, we have to recognize that appropriate actions may range from general protective measures to actions that significantly interrupt daily routine and/or incur significant direct or indirect cost. While it is relatively easy to list general protective measures that should or must be taken for a given threat level as done in your announcement of HSAS, there is a wide range of more-invasive actions that need to be taken and that will only be taken after a judgment call by individuals acting on their own or as leaders of organizations. These decision makers need to understand:

1. The Hazard: What event is likely to happen and how severe it is likely to be?
2. The Probability: What is the likelihood that the hazard will occur?
3. The Timing: When is it likely to happen? What is the time window for the event?
4. The Location: Where will the hazard occur?
5. The Source Credibility: What is the source of information? Is the source credible, reliable, and corroborated?
6. The Potential Costs of Taking Action: What are the direct and indirect costs of each potential response action?
7. The Potential Costs of Not Taking Action: What are the potential direct and indirect costs of not taking action?

Decades of experience in natural disasters and technological accidents show that an effective message must be clear, succinct, and address at least issues 1 thru 4 above. Otherwise the decision maker will make assumptions that may or may not be correct. The decision-maker will decide on issues 5 thru 7. In the case of terrorism, the decision-maker would like to know the credibility of the government's source. Furthermore, experience shows that combining two or more of these issues into one scale tends to confuse the communication.

The HSAS scale intentionally mixes risk and probability in order to have a simple, one-dimensional threat-level scale. This may not be an appropriate choice. It causes confusion both for the people deciding on the threat level and for those responding to the threat level. How high does the probability need to be before an "Elevated" risk should be classified a "High" threat? Clearly the response, especially if it significantly interrupts normal activity, should be quite different for events of low, moderate, or high probability.

From this perspective, we suggest that DOJ either use two separate scales for severity and probability or have an explicit definition of how the two scales are merged into one scale.

Examples of one-dimensional threat scales based on physical measurements of the hazard are:

Saffir-Simpson scale: Wind levels for hurricanes. Categories 1 to 5.

Richter scale: A quantitative measure of the size of an earthquake.

Air Quality Index: A quantitative measure of daily air quality based on a scale from 0 to 500 but typically expressed in a simplified scale: green, yellow, orange, red, purple, maroon, standing for good, moderate, unhealthy for sensitive groups, unhealthy, very unhealthy, and hazardous.

These scales express the severity of the hazard and can be used to compare anticipated events with past events. The likelihood of a future event needs to be specified separately. Experience with hurricane warnings shows that, in this case, people respond strongly to the wind scale but less strongly to varying probability.

An example of a merged scale is the Torino Scale used to categorize the likelihood of an asteroid collision. In this case the 5 colors define probability and the numbers add severity or rather extent of effect:

White: Events having no likely consequences

0. The likelihood of a collision is zero, or well below the chance that a random object of the same size will strike the Earth within the next few decades. This designation also applies to any small object that, in the event of a collision, is unlikely to reach the Earth's surface intact.

Green: Events meriting careful monitoring

1. The chance of collision is extremely unlikely, about the same as a random object of the same size striking the Earth within the next few decades.

Yellow: Events meriting concern

2. A somewhat close, but not unusual encounter. Collision is very unlikely.
3. A close encounter, with 1% or greater chance of a collision capable of causing localized destruction.
4. A close encounter, with 1% or greater chance of a collision capable of causing regional devastation.

Orange: Threatening events

5. A close encounter, with a significant threat of a collision capable of causing regional devastation.
6. A close encounter, with a significant threat of a collision capable of causing a global catastrophe.
7. A close encounter, with an extremely significant threat of a collision capable of causing a global catastrophe.

Red: Certain collisions

8. A collision capable of causing localized destruction. Such events occur somewhere on Earth between once per 50 years and once per 1000 years.
9. A collision capable of causing regional devastation. Such events occur between once per 1000 years and once per 100,000 years.
10. A collision capable of causing a global climatic catastrophe. Such events occur once per 100,000 years, or less often.

This 10-level scale could be expressed much more simply with just two words: a color and a scope (local, regional, global).

Another reason to separate risk and probability and even risk and hazard is to maximize the objectivity of the process of creating warnings. In the 1970's most seismologists thought that earthquakes might be predictable and a major national program was funded to measure

earthquake precursors. We found that when normally objective scientists were faced with low probability evidence that might predict a major earthquake and thereby save many lives, it was hard for them to keep their objectivity. The potential to save many lives tended to cloud their ability to be realistic about just how poor their observations might be. We ended up forming state and national prediction review panels to help sort the facts.

Similarly with terrorism, the events could be horrific, but the evidence may be of very low quality. By specifying the nature of the horrific event separately from the probability of its occurrence and even the credibility of the source of information, people hearing a warning get more accurate and specific information and are in a better position to decide what to do. Ten years ago, probability was not well understood nationally, but years of weather forecasts using probability have improved peoples' understanding. Probability can also be reduced to a 4 or 5 level scale such as unlikely, possible, likely, very likely, almost certain, but such words would have to be a clearly defined in a well-understood standard.

Having a simple, one-dimensional scale looks enticing, but will it get the job done?

There is also an issue whether HSAS should be based on hazard or risk. Hazard is the physical description of what could happen physically. Risk is an evaluation of the effects of the hazard, the costs in terms of life and property. A major hazard in an unpopulated region has low risk. Since terrorists tend to look for visibility and publicity, most terrorist events may be in densely populated areas, but should this be a core assumption? Is the risk different if a bomb is put in the ghetto or in the heart of downtown? What about contamination of a major potable water source where the hazard is low in some remote area, but the risk is potentially very high?

The ideal threat-level scale and the ideal methods of delivering warning information are still of little value without understanding and acceptance by the public. While HSAS focuses on Federal agencies, it alludes to the general public, as do the press stories on HSAS. Unfortunately these stories have had their greatest effect feeding lines to comedians because no one knows yet how to convert the color to a meaningful action by the average citizen. Again there has been a great deal of experience in addressing such problems and we believe this experience will prove useful in developing acceptance of HSAS.

In summary, we believe that HSAS might be made much more effective by expressing the hazard, imminence, probability, and credibility explicitly with a short set of adjectives and/or nouns. The color scale could be based on hazard, risk, or probability. There could be two or three color scales to address the different issues. These issues need to be discussed by those with the need to warn and those with experience in warning and in evaluating the effectiveness of warning. The mission of the Partnership for Public Warning is to bring such people together from all relevant fields of expertise to find the most effective solutions for the American people.

Sincerely,

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The Partnership for Public Warning

The Partnership for Public Warning was incorporated in January 2002 as a public/private, not-for-profit institute as recommended in several national reports and by 120 leaders in the field who met in November 2001 to discuss ways to improve warnings in the United States.

The **purpose** of the Partnership is to bring together representatives of all the many and diverse stakeholders to work toward a resolution of national standards, protocols and priorities that will assure the right information is delivered in a timely manner to people at risk from disaster, be it natural, accident, or the result of terrorism, so that they are enabled to act knowledgeably to save lives, reduce losses and speed recovery.

Disaster warnings, response, and losses are issues having **primarily local impact**, but a properly functioning national infrastructure to enable the generation and delivery of timely warnings and critical information is a **national responsibility.** To be effective, a public warning system must combine the efforts of government at the federal, state and local levels; businesses, including manufacturers, and service providers; academia; and the media.

The **basic national need** is for all-hazard, interoperable, integrated systems that collect warnings and relevant information from authoritative sources, verify them with local information, and distribute them through a wide variety of communication devices to the people that need to know.

In order to grab peoples' attention quickly, as well as to facilitate the sharing of information among emergency workers, the system requires a standard dictionary of terms, warning preparation standards, information formatting standards and communication standards. Without these, industry is unable to build and implement economically viable or technologically feasible warning solutions.

Unfortunately, existing warning systems do not focus only on the people at risk, and often use outmoded technologies. Many are unable to deliver information fast enough during rapidly changing situations. Many are incompatible. Some require special hardware used only in emergencies. There are few secure, national channels and even fewer standards for collecting and verifying all-hazard warnings. Local emergency managers often have trouble relaying their information. Most systems for sharing information during disasters are not fully interoperable. We need a quick turnaround virtual "clearinghouse" and virtual "meeting place" where the emergency community is able to share their information and where those at risk have access to authoritative information.

Public warning is **not just a problem of technology**. We need better information on how to get people to respond to emergency situations more effectively. Improved public education is vital. We need agreement on key data to be collected. We need real-time analyses of immense amounts of data, ways to convert information to knowledge, and ways to select and deliver the key information for people with different needs. We need to better understand the legal and economic implications of disaster information and its various delivery modes. We need to do a better job building public trust in warning systems.

The Partnership for Public Warning is in the process of involving representatives of the many stakeholders in warning systems from across the country and at all levels. The Partnership seeks to **add value** to the work of so many different people and organizations involved with emergency warning and information. Our goal is to foster better coordination and cooperation through consensus on what could and should be done, how it can be phased in with existing systems, and what standards should apply. We need to develop a coherent framework where all the diverse stakeholders can contribute their expertise and have it work well with others. In this way, business will be better able to seek and evaluate business opportunities to provide disaster information. In February, the National Emergency Managers Association endorsed the Partnership.

The Board of Trustees of the Partnership includes the following leaders:

Art Botterell – Emergency Public Information Systems Consultant (retired from California Office of Emergency Services and FEMA.) Developed EDIS, the Emergency Digital Information Service, for the State of California.

Darrell Ernst – Lead Defense Space Systems Engineer, The MITRE Corporation. Developed GEOcast, a location specific, communication technology.

Sol Glasner – Vice President, General Counsel and Secretary, The MITRE Corporation

Mike Hoban – Vice President, 3e Technologies International

Ken Keane – Principal, Arter and Hadden, specializing in wireless frequency issues

Dave Liebersbach – Director, Alaska Division of Emergency Services

Frank Lucia – FCC Emergency Alert System, retired

Dr. Dennis Mileti – Director, Natural Hazards Research and Applications Information Center, Chair, Department of Sociology, University of Colorado at Boulder

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Ben Rotholtz – General Manager, Products and Systems, RealNetworks

Richard Rudman – Director of Engineering, KFWB Radio, Chairman FCC's Emergency Alert System National Advisory Committee (NAC).

Ed VonTurkovich – Director, Vermont Emergency Management

Dr. Peter L. Ward (Chair) – U.S. Geological Survey, retired. Former Chairman of the Working Group on Natural Disaster Information Systems under the National Science and Technology Council

The following represent Federal agencies to the Board:

Dale Barr – National Communications System

Jeng Mao - National Telecommunications and Information Administration

Ken Putkovich – Chief, Dissemination Systems, NOAA, National Weather Service

Tim Putprush – Primary Entry Point Coordinator, FEMA

Fred Schamann – NASA Goddard Space Flight Center

George Wilcox – Corporate Liaison, NOAA

Many others from government and industry are involved in Board meetings and committees.

Some Examples of Threat-level Scales

Air Quality Index: Used by the EPA to report daily air quality. Scale from 0 to 500 but 6-level simplified scale is often used to communicate to the public: green, yellow, orange, red, purple, maroon, standing for good, moderate, unhealthy for sensitive groups, unhealthy, very unhealthy, and hazardous. http://www.epa.gov/airnow/aqibroch/aqi.html#2

Torino Scale: Used to categorize the likelihood of an asteroid collision. Ten levels simplified with 5 colors: white, green, yellow, orange, red. The colors relate to likelihood, the numbers add potential risk (local, regional, or global). http://explorezone.com/space/sub/torino_scale.htm

Richter scale: A quantitative measure of the size of an earthquake. When used to discuss threat, it provides a way to compare a future event with past events.
http://www.seismo.unr.edu/ftp/pub/louie/class/100/magnitude.html

Risk Assessment Criteria: Threat level of a computer virus: low, medium, high, very high. Combination of distribution (widespread, not widespread) and damage (damaging, slightly damaging). http://www.pandasoftware.com/library/indice_en.htm

Symantec Security Response Threat Severity Assessment: Threat level for computer virus based on the number of machines affected, the damage caused, and the rate the virus spreads. Five levels: Very low, low, moderate, severe, very severe.
http://securityresponse.symantec.com/avcenter/threat.severity.html

Degree of Threat: Proposed for threat from severe weather conditions in Florida by NOAA/NWS staff. Five levels: Hazard threat, high hazard threat, very high hazard threat, becoming extreme hazard threat, extreme hazard threat. Colors: light yellow, yellow, light orange, orange, red. http://www.srh.noaa.gov/mlb/ghwopres00.htm

DEFCON: The DEFense CONdition threat scale specifying phased increases in combat readiness based on the likelihood of war. http://www.fas.org/nuke/guide/usa/c3i/defcon.htm

US Nuclear Plant Emergency Scale: Four levels of emergencies: notification of unusual event, alert, site area emergency, general emergency. http://www.nucleartourist.com/operation/e-plan.htm

International Nuclear Event Scale: Eight-level scale (0-7) based on severity and area of impact: Deviation, anomaly, incident, serious incident, accident without significant off-site risk, accident with off-site risk, major accident, serious accident. http://www-news.iaea.org/news/inesmanual/ines2001.pdf

Technical Surveillance Threat Levels: Ten-level threat scale posed by technical surveillance devices based on the difficulty of detecting the device. Each level correlates to specific types of eavesdropper, and equipment being used. Each level also correlates to a specific type of counter-measure inspection, methods, and procedures. http://www.tscm.com/threatlvls.html

Natural Gas Transmission And Distribution Threat Levels: Normal, low, medium, high.
http://www.texasgas.com/Security%20Measures.htm

Volcano Condition Code: Four levels: No immediate risk, watch, warning, and eruption in progress (Green, yellow, orange, red). http://geopubs.wr.usgs.gov/bulletin/b2185/

U.S. Customs Service Alert Levels: Four-level code: Normal operations, normal operations with heightened awareness, increased level of operations, and sustained intensive anti-terrorism operations. (Green, blue, yellow, and red).
http://www.customs.ustreas.gov/news/sept11/alertstatus.htm

WMD CONPLAN: Establishes a range of threat levels determined by the FBI that serve to frame the nature and scope of the Federal response. Four levels: minimal threat, potential threat, credible threat, WMD incident. http://www.srh.noaa.gov/mlb/tcworkshop_2001/slide14.html

How People React to Warnings

The following lists show the many factors involved in how people react to warnings. Which factors are most important vary with type of hazard and the given situation.

Sociologists find that responses to warnings of catastrophe tend to follow these steps:

1. Perceiving the warning (hear, see, feel)
2. Understanding the warning
3. Believing that the warning is real and that the contents are accurate
4. Confirming the warning from other sources or people
5. Personalizing the warning
6. Deciding on a course of action
7. Acting on that decision

Further, a distinction is made between sender and receiver characteristics for each of the components.

Sender characteristics focus on:

1. The nature of the warning messages (content and style)
2. The channels through which the messages are given (type and number)
3. The frequency by which the messages are broadcast (number and pattern)
4. The persons or organizations receiving the message (officialness, credibility, and familiarity)

Receiver characteristics are primarily:

1. Environmental (cues, proximity)
2. Social (network, resources, role, culture, activity)
3. Psychological (knowledge, cognition, experience)
4. Physiological (disabilities)