U.S. Environmental Protection Agency
Region 6

Final Regional Lessons Learned Report on the Space Shuttle Columbia Response

September 2, 2003

I. OVERVIEW

The following Lessons Learned Report reflects the retrospective observations and recommendations of Environmental Protection Agency (EPA) personnel involved in this effort, including front-line responders, technical and support personnel, Headquarters and Regional management. In no way should candid observations included in this report be represented as critical of the outstanding performance of so many individuals or the demonstrated effectiveness and capacity of EPA as an organization. The report is intended as constructive feedback to and from the agency on its Space Shuttle Columbia response in order to maximize learning from the event.

In addition to the application of professional emergency response knowledge and skill to unfamiliar challenges, EPA personnel devoted extraordinarily long hours to difficult and stressful work. Agency resources were mobilized and coordinated with both national and Regional support. The four-month response involved many EPA personnel and required coordination with numerous other Federal, state and local agencies. These challenges were successfully met.

The following sections describe the methodology of the report, EPA response and coordination efforts concerning its involvement in the Space Shuttle Columbia recovery efforts, lessons learned and emergent themes. Appendix I provides a detailed summary of the June 3, 2003 Hotwash on Shuttle response operations conducted by EPA Region 6**.**

II. REPORT METHODOLOGY

A. Interviews

A focused study based on interviews of 21 individuals was conducted from May 28, 2003 through July 31, 2003. Interviewees were asked to identify the most significant positive aspects and the areas where improvement was needed in their area(s) of responsibility. Additionally, interviewees were asked to give an overall assessment of the EPA response. Specific interview questions were geared toward positions in the following locations:

- Disaster Field Office (DFO)
- Field Operations
- Headquarters (HQ)
- Other Federal Agencies
- EPA Regions 1 - 5, 7 - 10, & Environmental Response Team Removal Managers
- Region 6 Regional Response Center (RRC)

B. Hotwash

On June 3, 2003, EPA Region 6 hosted a day-long meeting to discuss issues related to the Space Shuttle Columbia Response. Participants identified the top positive aspects and areas needing improvement as related to Incident Command System (ICS) categories. Discussion was framed by the following ICS components:

A. Overall ICS Management
B. Planning
C. Operations
D. Logistics
    1. Facilities
    2. Communications
    3. Infrastructure
    4. Supplies
E. Staffing
F. Information Management
    1. Data Management
    2. Public Information
G. Health and Safety
H. Financial Management
I. Liaisons with other Agencies
J. Other Issues

C. Lessons Learned Documents

In the months following the Space Shuttle Columbia Response, EPA Region 6 has generated and received written comments, suggestions and best practices. This information was gathered from internal Region 6 lessons learned meetings and through e-mail communications with those involved in the Space Shuttle Columbia Response. The raw data was compiled to identify emergent themes, perspectives and patterns.

III. BACKGROUND

A. The Event

On Saturday, February 1, 2003, the Space Shuttle Columbia disintegrated 40 miles above the Earth, resulting in loss of the vehicle and the crew of seven astronauts. The National Aeronautics and Space Administration (NASA) Mission Control had lost contact with the shuttle around 9am EST, 16 minutes prior to its scheduled landing at the Kennedy Space Center in Florida. Just prior to the loss of communications, the astronauts and flight controllers received a left landing gear tire pressure warning. At this time, Columbia was traveling at a rate of 13,500 miles per hour. Data showed that the temperature rose 60 degrees (F) in five minutes on the left side of the fuselage (five times faster than on the right side), a series of sensors on the left wing were lost and the vehicle rolled unexpectedly to the left.

Observers on the ground in Texas could see pieces of the shuttle breaking away and debris was scattered over thousands of square miles in Texas and Louisiana. Some material may have been vaporized, but a significant percentage made its way to the ground.

EPA Region 6 dispatched an emergency response crew within hours of notification on the presumption that EPA assistance might be required. Later that afternoon, as reports of debris sightings flooded the media, the decision was made by President Bush to organize recovery efforts under the Federal Response Plan (FRP), with the Federal Emergency Management Agency (FEMA) as the lead agency. EPA was issued an initial Emergency Support Function (ESF) 10 Mission Assignment and began to plan for HAZMAT recovery operations.

B. Response Operations

During the first week of operations, the learning curve for all the participating agencies was very steep. Over the first four days it became apparent that the EPA protocols established for hazardous debris could also be effectively applied to document and manage the non-hazardous materials. The scope of EPA's Mission Assignment grew exponentially as EPA was tasked with the overall management of debris recovery in Texas. The smaller-scale Louisiana operations were managed by that State with minimal federal involvement.

By the third day of the response, EPA Region 6 operations were supplemented by resources from other EPA Regions and HQ. As the designated backup office, Region 7 initiated a national mobilization of OSCs. By the end of the first week, over 60 OSC-led teams were in the field in east Texas with additional personnel staffing field command posts, the Lufkin DFO and the Dallas RRC. Specialized assets deployed included ERT's Trace Atmospheric Gas Analysis (TAGA) unit, the Airborne Spectral Photo-Imaging of Environmental Contaminants (ASPECT) air monitoring platform, the EPA Region 7 dive team, and the Environmental Response Team (ERT). Field operations were coordinated with the recovery and security efforts mounted by State and local agencies.

This level of operations was sustained through February 2003. By that time, most of the reported debris locations had been cleared, and the operation shifted to intensive searches of remote areas. For this phase, up to 4,000 U.S. Forest Service (USFS) fire fighters were brought in to conduct line searches, with EPA providing the technical support for debris management. By the end of April, most areas had been cleared and the operation began to phase down.

At the completion of the project, EPA's database recorded approximately 82,500 pieces of shuttle material recovered by air and ground operations. The total weight of recovered material was 84,800 pounds, or 40 percent of the 222,900 pound dry weight of the shuttle.

The FEMA final summary (No. 3171-71; Release date May 5, 2003) included the following descriptive statistics on the scope of the operation:

- Ground, water and air searches combined covered more than 2.28 million acres.
- Water operations located and investigated more than 3,100 targets over 60 square miles.
- More than 16,500 ground search personnel and support personnel searched 680,748 acres.
- Total man-hours utilized in the recovery effort are estimated at approximately 1.5 million.
- Under the FEMA Public Assistance program, $10 million is the amount projected for Texas to reimburse eligible costs associated with the recovery effort. As of May 1, $3.98 million has been obligated. For Louisiana, projected reimbursable payments are $500,000, with $396,000 already obligated.
- Searches have been concluded in New Mexico and California and continue in Nevada and Utah.
- No debris has been found west of Littlefield, Texas or east of Fort Polk, Louisiana.
- More than 130 Federal, state, and local agencies participated in the recovery effort.
- Approximately 25,000 personnel took part in the recovery operation.

IV. THE NATIONAL PERSPECTIVE

The Space Shuttle Columbia recovery project has been an extraordinary accomplishment for EPA and its partners. From the initial response through the final effort, which spanned over four months, the resiliency, technical capability, and staying power of the EPA emergency response program was tested and found sound. At the same time, EPA reserves were severely drained and there were notable issues and problems that made the response more difficult.

In the course of interviews and meetings with the participants, several consistent themes emerged. This section describes these themes and how they relate to the overall national perspective of the EPA emergency response program.

A. The EPA Emergency Program Works

EPA's emergency response infrastructure provides a solid foundation for responding to major events, especially those that have no precedent and therefore require an adaptive and innovative approach to the response. The basic components of the program, including the OSCs, the support contractors (Emergency and Rapid Response Services (ERRS) and Superfund Technical Assessment and Response Team (START)) and the overall administrative and management support structure have proven their effectiveness. Based on the extensive interviews and data review, it appears that no major overhaul is needed.

Several attributes of the program stand out. First, the overall commitment by OSCs and support personnel was universally praised. Their willingness to work long shifts and extended tours under extremely stressful conditions is a tribute to the "can do" culture of the program. The down side of this attitude is the tendency of personnel to over-extend themselves, thus creating potential risks of injury or sub-optimum performance. Several responders recommended that EPA consider mandatory limits on length of shifts and tours (such as those used by USFS) and that a higher priority be placed on placement of relief and backup personnel.

Second, the technical excellence and resourcefulness of the responders was notable. In particular, the capture and management of field data was a major positive aspect of EPA's response. EPA and the START contractor were able to adapt tools from their experience of HAZMAT operations to the needs of the Columbia project quickly, effectively and reliably. Data entry in the field was accomplished using EPA utilized portable Global Positioning Systems (GPS), digital cameras, and personal digital assistants (PDAs). In the end, the only stable and comprehensive database of recovered materials was with EPA. The apparent ease with which EPA managed the acquisition and overnight processing of data from dozens of field teams working out of several isolated command posts required a great deal of behind the scenes effort by support personnel.

The rapid deployment of specialized technical resources, such as the ASPECT platform, the TAGA unit and the underwater survey and dive teams should be viewed as a success. Even

though most survey results were negative, their early and visible presence provided valuable reassurance to community members and excellent demonstrations of the capabilities and limitations of the various technologies. In addition, these results assisted the effort to downgrade PPE levels, thus improving overall efficiency while maintaining safety.

The most frequently mentioned technical issue was inadequate communications infrastructure, especially during the first weeks. The remote locations of field operations created numerous gaps and breaks in cellular phone and broadband internet connections, making operational coordination much more difficult. The deployment of satellite-based communications links was somewhat effective.

B. A True National Response

The scope far exceeded the stand-alone capacity of Region 6, however, the rapid initiation of backup region operations by Region 7 enabled a remarkably smooth mobilization, drawing on the nationwide reserves of the emergency response program. In effect, this response served as an early test of the National Approach to Response (NAR), which envisions how national reserves can be mobilized to support the impacted region.

At one point, approximately 25 percent of the national response capacity (as measured by the number of OSCs deployed) was committed to the Columbia response. This massive effort resulted in concerns regarding the overall reserve capacity of the program, particularly during the Level Orange alert that occurred during the response. These concerns were exacerbated by the withdrawal of other agencies (most notably the U.S. Coast Guard (USCG)) from the response because of redeployment priorities. Consequences of the national deployment will continue for some time, since it forced each Region to defer site projects and programmatic activities.

A second wave of support was provided by other EPA programs. The Columbia response validated the concept of the Response Support Corps (RSC) initiative, where pre-qualified, non-emergency staff are deployed to provide support to field personnel. Numerous instances of valuable technical, administrative, financial and logistical problem solving by RSC staff were noted during the interviews. At the same time, there was a consensus that those staff members need additional training to enable smoother integration within the response management structure.

The sheer number of staff deployed created numerous problems in matching individuals to the needs of the response. The need for a system to track and manage personnel and resources was frequently mentioned.

C. The Incident Command System Works

The Incident Command System (ICS) has become a proven tool for managing large scale, interagency responses. Although ICS implementation was uneven here, there is consensus among the responders that it remains the most effective way to organize and manage a dynamic and crisis-driven operation. The difficulties encountered while establishing clear and consistent ICS operations can be surmounted by improved and expanded training programs for EPA responders and support personnel.

ICS was most completely implemented at the Field Command Post level, although there was a great deal of variability in this during the first weeks of the response. Successful implementation is attributed to the degree of training of the responders, the amount of emphasis placed on ICS by the Command Post, and the adequacy of the facilities—including working space, communications infrastructure and proximity to other agency operational centers.

At the tactical level, many responders were impressed by the effectiveness of the USFS model for ICS implementation. The USFS Incident Management Teams provided a clear example of how ICS can be rapidly established and consistently maintained. On the other hand, several observers noted how resource-intensive the USFS model is, and expressed doubts that EPA could afford the commitment of so many personnel to a response.

Another frequently noted problem at the Field Command Post level was the difficulty many OSCs had in assuming the narrowly defined roles within ICS command and staff teams. The EPA emergency response culture has long relied on a single OSC as the "field manager" for a successful operation. This role must be replaced by a clearly defined set of focused responsibilities. The single most frequent recommendation from the interviews was for improved and more comprehensive ICS training. It was also repeatedly noted that not all ICS command and general staff positions need be filled with OSCs. Some, notably Information Officer and Finance Officer, would be better staffed with program specialists.

An ICS structure also proved useful at the DFO. Within the ESF-10 group, ICS staff positions played key roles in coordinating operations between the field command posts, while the Incident Commander served as the principle contact for the Federal Coordinating Official (FCO).

At the Area Command level (i.e., the Region 6 office), ICS was not completely implemented. This may be partially due to the lack of a clear delineation of responsibility between the EPA Area Command and the ESF-10 command at the DFO.

At EPA Headquarters, a National Command was not implemented; this may be largely due to the lack of any incident-driven demands on HQ resources —the HQ Emergency Operations Center (EOC) was only operational for the first six days of the incident. However, some ICS protocols were established during that period, most notably (and most appreciated by the Region) was the channeling of information requests from HQ to the region through a liaison officer, thus minimizing duplication of effort and improving consistency. Frequent national conference calls, both intra and inter-agency, were effective in conveying operational information. On the other

hand, some key policy issues were handled outside the national incident management structure (see following issue).

D. Senior Management Interface Needs Improvement

Although Regional and HQ senior managers were universally positive in their assessments of the response, there were several instances, particularly during the first two weeks of the operation, where policy direction was not clearly related to operations.

The interface between agency senior managers and the response management system showed serious gaps. Overall policy direction at the political appointee level may have been initiated without adequate information regarding the impact on the response, and may have been conveyed in such a manner that lead to conflicting interpretations. This issue was further complicated by the inter-agency relationships that arise from FRP activations. For example:

- The expansion of the ESF-10 Mission Assignment to include non-hazardous debris collection led to questions regarding agency authority to conduct large scale operations that may have been more appropriate under the authority of ESF-4 (U.S. Army Corps of Engineers (USACE) for debris management) or the National Transportation Safety Board (NTSB), although neither of these agencies had the technical or logistical ability to conduct the response. This issue was exacerbated by queries from Office of Management and Budget (OMB) to HQ, which indicated a potential for the agency not to be reimbursed for non-hazardous operations, creating serious mission and budget concerns by agency senior managers.

- Commitment of up to one-quarter of agency response resources to one incident led to concerns over response capacity available for Counter Terrorism response. The Level Orange announcement created a perceived need by some upper managers to move responders back to Regional bases, a perception generally not shared by response personnel. At the upper management level, however, the lowering of the response commitment of other agencies (e.g., USCG and U.S. Army Corp of Engineers) created concerns that EPA may be "out of step" with overall federal priorities and overcommitting to the mission.

Reaction to these issues at the agency upper management level led to articulating the need to reduce agency commitment to the Columbia response. However, these intentions were not formalized as executive decisions, but rather were expressed verbally through the political level chain of command. This created a variety of interpretations in the Regional and HQ offices. At the extreme, some Regional managers began moving to implement a complete phase-out of the EPA operation, causing extensive concern and confusion at the DFO level and leading to strong concerns on the part of various other agencies, particularly NASA.

In the end, this series of crises were effectively curtailed by an interagency Chief of Staff meeting involving FEMA, NASA, EPA, and OMB. The meeting resulted in agreements regarding priorities and commitments. In addition, it was decided that the response commitment by EPA would continue, and was determined to be fully reimbursable and within the scope of ESF-10 Mission Assignments.

The National Approach to Response (NAR) model provides a link from senior agency managers to the response management structure, but these links were not effectively utilized. Moreover, the current version of the NAR does not adequately deal with the complications of Stafford Act responses, which bring other agencies into the decision making process.

This sequence of situations leads to the following conclusions:

- Policy decisions and determinations at the political appointee level need to be clearly articulated, documented, and communicated to the response management structure within the roles and context of the established ICS structure.
- When these decisions have serious potential impact on other agencies, the leadership of those agencies should be consulted prior to the decision.
- Major interagency responses should generate the early formation of high level ad hoc roundtables before crises escalate. An investment on the front end of a response to establish contacts and communications links averts potential crises. In effect, this group would function as an executive level, incident-specific National Response Team.
- The NAR should be modified to include a variant that addresses the more complicated management of interagency Stafford Act operations.
- The NAR also needs to improve the links at both HQ and Regional levels between senior managers and the response management structure.
- As the Homeland Security Threat Warning System matures, a consistent set of measures associated with each level should be implemented.

The Columbia response occurred during a period of transition for the EPA emergency response program. Changes in program emphasis, staffing, organization and policy that were set in motion by the events of 2001 remain in motion. The Columbia response provides an opportunity to validate or correct the direction of these changes. In particular, the experience during this response has implications for EPA's NEAR (the proposed directive for ICS implementation and the new ICS training program), the emerging Incident Management Assistance Team (IMAT) project, the next generation of Core Emergency Response Program standards, and the RSC concept (for integration of non-emergency response personnel into the response organization). In general, the Columbia recovery experience reinforces the need for and the direction of each of these program initiatives, but each could be made more effective by taking into account the collective observations of the responders.

EPA has been required to respond to three nationally significant events in the past 18 months, each without situational precedent and involving the extension of EPA operations far beyond any

previous experience. Prudence suggests that EPA should assume that such events will continue to occur, and that they will probably present similar dilemmas. The agency response management structure and processes should prepare for such events, thus maintaining the flexibility required to successfully respond to yet-unknown crises.

V. CONCLUSION

The EPA response to the loss of Space Shuttle Columbia was the largest it has ever been involved in under the FRP. Further, with response to two other major incidents (World Trade Center and Anthrax) within18 months, EPA demonstrated that it could make a significant contribution to large scale responses. EPA worked closely with FEMA, NASA, USFS and many state and local agencies to ensure effective and efficient hazardous materials management. In the end, EPA's emergency response program demonstrated its vast knowledge and experience in responding to a national incident and coordinating with many other agencies.

Although the Space Shuttle Columbia response was successful, there are lessons learned that should assist EPA with further improvement and refinement of its emergency response program. First and foremost, EPA demonstrated that ICS is an effective way to structure a response. Second, effective communications and data management resulted in better and informed decision making. Third, in support of a true national response, EPA Region 6 was able to garner the resources available to it from its backup Region, Region 7, and other Regional and Headquarter assets. Finally, the proposed National Approach to Response will provide a link from senior managers to the response management structure, thereby optimizing policy decisions that affect response efforts.