August 13, 1998

FOR: The Commissioners

FROM: L. Joseph Callan /s/
Executive Director for Operations

SUBJECT: UPGRADING THE NRC OPERATIONS CENTER EMERGENCY TELECOMMUNICATIONS SYSTEM

PURPOSE:

To obtain Commission approval for a near-term and mid-term strategy for maintaining reliable service for the NRC Operations Center Emergency Telecommunications System.

BACKGROUND:

The Emergency Telecommunications System (ETS) is the system of telephone circuits and equipment that NRC relies on during an emergency to communicate with all commercial nuclear power plants (NPPs) and major fuel cycle facilities. The need for a highly reliable telecommunications system that is independent of the local telecommunications capabilities was a lesson learned from the Three Mile Island (TMI) accident. During the first few days of the TMI accident, the NRC experienced considerable communications problems with the site. These communication problems were largely caused by overload at the local telephone company switch. At the request of NRC Chairman Hendrie, President Carter sent White House Communications Agency representatives to the site to establish a dedicated network between NRC headquarters, the Governor's office, and the NRC onsite trailers. This dedicated network remained in place and in use for nearly a month after the accident.

CONTACT: John R. Jolicoeur, AEOD
(301) 415-6383

In the aftermath of the TMI accident, the NRC established two dedicated telephone systems for emergency communications: the Emergency Notification System (ENS) and the Health Physics Network (HPN). The ENS, used by NRC to receive information from the licensee on plant safety status, was a ring-down phone system that terminated at four different places on the licensee's end: the Control Room, the Technical Support Center, the Emergency Operations Facility (EOF), and the NRC Resident Inspector office. Taking any one of these extensions off-hook automatically activated the dedicated circuit to the Operations Center. The HPN, used to convey radiological and dose projection information, consisted of eight multidrop (similar to party line) dedicated circuits. Each HPN circuit terminated at a regional office and at the NRC Operations Center (NRCOC), as well as at all power plants and fuel cycle facilities on each respective loop. In 1987, the unreliable and expensive HPN service was transferred from dedicated circuits to the public switched network (PSN). By 1990, AT&T and the regional Bell operating companies (RBOCs) had migrated to digital systems, and the equipment associated with the analog private ENS lines was no longer being manufactured. Consequently, by 1990, the cost of maintaining an increasingly obsolete dedicated network exceeded $5 million annually (in 1998 dollars).

In 1991, the staff upgraded the ETS (SECY-91-149 and SECY-91-303) to the present system. A simplified diagram of the existing system is provided as Attachment 1. The system uses the General Services Administration's (GSA's) Federal Telecommunications Services (FTS) 2000 network for long-distance service in conjunction with direct-access lines (DALs) from the closest FTS 2000 point of presence to the site. The DALs are essentially dedicated circuits to the sites that are not switched at the local telephone company central office -- eliminating the problem that occurred during the TMI accident.

The present system was designed on the basis of an assessment of what would be needed for incident response. The design incorporates seven essential communication functions which were first presented to the Commission in a memorandum from Victor Stello, Jr., Executive Director for Operations, on September 9, 1988 (Attachment 2). Each nuclear power plant has DALs for each of the seven emergency communications functions. Nearly half of the sites have offsite EOFs that are sufficiently remote from the reactor site to require additional separate DALs. The DALs were installed between 1991 and 1992 in accordance with the guidance in Generic Letter 91-14, "Emergency Telecommunications." Since that time, the ETS has provided reliable and (until recently) relatively low cost phone service that substantially meets the needs of the NRC incident response program. However, the staff has identified new factors that affect the existing ETS and that may require further modification of this system.

DISCUSSION:

1.0 STRATEGIC FACTORS AFFECTING THE EXISTING ETS

Operating Costs Have Substantially Increased. Beginning in 1995, the operating costs associated with the current configuration of the ETS increased from less than $100K to approximately $800K per year due to changes in the GSA FTS 2000 contract.

Future Uncertainty of FTS 2000. The FTS 2000 contract for federal long-distance service expires at the end of 1998. Although no formal announcement has been made, GSA indicated to the staff that the FTS 2000 services utilized by the ETS will be continued for at least six months under a continuity of service clause in the contract. Once this contract expires, GSA will no longer require mandatory use by Federal agencies. The Post-FTS 2000 Program Strategy developed by GSA continues to evolve in response to feedback from stakeholders. Although not mentioning DALs specifically, the FTS 2001 Request for Proposals (RFP) does require support for users' legacy systems. This would indicate that DAL-type service will continue to be offered and supported. However, the cost of such support can only be expected to increase.

The Telecommunications Act of 1996. The implications of the Telecommunications Act of 1996, also referred to as the Telecommunications Reform

Act, are just beginning to emerge. One major feature of the Act is to allow RBOCs to enter the long-distance, wireless, and video markets, and to open the local telephone service market to competition from long distance carriers and the cable television industry. This Act has the potential to fundamentally change the telecommunications industry, and in doing this, to create a great deal of uncertainty, as well as potential opportunity.

Emerging Technologies. Low cost portable satellite units, asynchronous transfer mode, enhanced Government Emergency Telecommunication Service (GETS), and cellular priority service may result in ETS options that are more reliable and less costly than the present system.

Diversity. Because a study showed that a satellite backup would only slightly improve the reliability of communications during an emergency, the staff recommended upgrading the ETS without employing a satellite backup system (SECY-91-303). This recommendation was based on the assumption that a satellite link would be as vulnerable to external events (e.g., earthquakes, hurricanes) as the FTS 2000 system. The staff requirements memorandum in response to SECY-91-303, approved the staff's plan to upgrade the ETS without a redundant satellite system. However, since that time, the staff has attempted to establish a diverse means of communicating with the sites, particularly in light of the lessons learned from Hurricane Andrew.(1) Currently, headquarters and each regional office has a portable satellite unit that can be deployed to a NPP site that is threatened by a hurricane.

2.0 STAFF ACTIONS TO ADDRESS CONCERNS WITH THE EXISTING ETS

The staff made a comprehensive effort to address the concerns with the existing ETS. The staff hired a consultant, Booz-Allen & Hamilton (BAH), to help it determine, from a technological and economic standpoint, the most effective and most appropriate way to provide communications between the NRCOC and the NPP sites. The BAH report is attached (Attachment 3). The staff has also worked extensively with the National Communication System (NCS) to explore new methods for ensuring call completion during an emergency. At the request of the NRC, NCS conducted a preliminary assessment (Attachment 4) on whether the Government Emergency Telecommunication Service (GETS) could serve as a viable alternative to the DALs. This assessment concluded that the GETS alternative is "likely to be both operationally acceptable and economically beneficial." Background information on the NCS and its GETS and Telecommunications Service Priority (TSP) programs is provided as Attachment 5.

The NRC staff is evaluating all of the DALs to determine which of these lines could be eliminated. To date, the staff has identified and initiated disconnect orders for approximately 100 DALs that could be removed without decreasing the effectiveness of the NRC incident response capability. Although the staff's evaluation is still ongoing, the estimated annual savings from eliminating 100 DALs is approximately $86,000.

Regular discussions are held with GSA to determine the status of the FTS follow-on contract. An RFP has been issued for the follow-on contract, FTS 2001. Should the NRC want to continue to utilize the FTS system, we have assurances that legacy-type systems (such as DALs) will be supported under the new contract. What is uncertain is the cost of those identical or similar services under FTS 2001, although cost is expected to increase. The exact costs will not be known until the contract is awarded.

In the past several years, the staff has taken a number of steps to increase the diversity of the ETS. The NRC has participated in interagency programs that provide for the use of shared telecommunications assets during an emergency. One portion of this program is managed by the National Interagency Fire Center (NIFC) in Boise, Idaho. NIFC has committed to deploy its assets, including satellite telecommunications equipment and hand-held radios, to a site within 12 hours after an NRC request. In fact, NIFC assets have been deployed on several occasions, including the response to Hurricane Andrew. In addition, NRC has purchased portable satellite units through NIFC and has placed them at all of the regional offices and at headquarters. This has allowed NRC personnel to pre-deploy satellite communications equipment in advance of hurricanes. However, because the path of a hurricane may be unpredictable, and because more than one site may be potentially affected, deployment from the regional offices has proved to be less than optimal.

Although prepositioned portable satellite units improve communication diversity at NPPs, they are not an optimum solution for emergency telecommunication. The staff recommends the use of these portable units following severe events which cause total loss of communication infrastructure at a NPP and in the surrounding community. Satellite units would be used by the resident staff or licensee personnel to provide periodic updates of plant conditions when normal communications are not available. Since normal operation of the portable satellite units requires setting up outside, the resident staff would have to choose between monitoring the event and communicating status to headquarters and the region. In addition, any radiological release would complicate the outdoor use of these units. The staff has included the use of prepositioned satellite units in some of the mid-term options to provide an independent and diverse communication capability of last resort for use during disasters which otherwise destroy the local infrastructure.

3.0 IDENTIFICATION AND ASSESSMENT OF OPTIONS

Near-Term Options (Approximately 2 Years).

The staff has concluded that, in the near term, the NRC should continue to rely upon the existing ETS. This is consistent with the primary recommendation of the BAH study which also recommended that NRC deploy backup mobile satellite capability to all plant sites, not just the regional offices. In addition, BAH recommended that NRC use GETS to provide additional backup capability. The annual savings from the staff's DAL reduction effort could be used to offset the cost of purchasing or leasing mobile satellite equipment (assuming ETS funding at the FY 1998 level of $780K and all other factors remaining constant). Since the FTS-2000 contract expires in December 1998 and the cost of DAL service is expected to increase following the expiration of that contract, the staff is not recommending the purchase of portable satellite units in the near-term. Selection of this option reflects the recognition that the current level of ETS service is both necessary and sufficient for incident response and a commitment to fund this service as necessary to reflect potential changes in cost. This first option is summarized in Table 1.

The staff has developed a second option, also summarized in Table 1, which acknowledges the reality of declining budget conditions and the possibility of a future increase in the cost of the DALs. The cost of DAL or foreign exchange (FX) service following the termination of the FTS-2000 contract is uncertain. However, it is possible that the costs could increase significantly, beyond what is currently budgeted. If additional funds are not available for this purpose, the staff recommends retaining the ENS and the Emergency Response Data System (ERDS) functions at all NPPs. The staff also recommends that the ENS line and the Operations Center LAN line be maintained in the EOF and that one connection for the site team be retained in the

TSC and the EOF. The staff does not recommend this as a permanent solution, but as an interim option which would be used to bridge the time between the increase in ETS costs and the implementation of one of the lower cost mid-term options.

Table 1. NRC Emergency Telecommunication System Near Term Options

Option	More or Less Reliable than Current ETS	Rulemaking Required	Cost Relative to Current ETS
Near-Term Option 1 (Approximately 2 years)	Same	No	Same while the FTS-2000 contract remains in effect. The contract expiration date is December 6, 1998. The cost of the ETS after this date is uncertain and could be considerably higher.
Maintain current ETS system utilizing DAL or FX service. GETS will continue to be used as appropriate.			
A substantial increase in the cost of the ETS is possible after 12/98. An increase in the cost of ETS is not currently reflected in the budget.			
Near-term Option 2 (Approximately 2 years)	Same	No	Same
This option is identical to Option 1 except that it provides for a reduction in the number of ETS functions. For example, for a single unit site, the number of DALs would be reduced from the current level of 11 (7 for onsite EOF) to 6 (4 for onsite EOF). This would be done by relying on the Emergency Notification System for protective measures information (i.e., eliminating the Health Physics Network) and consolidating the Reactor Safety			
Counterpart Link, the Protective Measures Counterpart Link, and the Management Counterpart Link into a single communication link with the site team. This strategy will place greater reliance on links for ERDS and the LAN (referred to as E-mail in Attachment 2).			

Mid-Term Options (2-3 years).

The BAH study concluded that some utility telecommunication systems are very robust and recommended that, in the mid-term, the NRC should require licensees to support all ETS circuits with their own communications systems. All NPPs have their own communications systems designed to support emergency and administrative functions. They are used to communicate with corporate headquarters and with State and local emergency officials. The utilities' systems, which generally do not follow the same route as commercial telephone lines, have evolved significantly since TMI (e.g., NUREG-0654 requirements for offsite communication). Some of these systems are so extensive that some licensees are considering selling excess capacity to the public in direct competition with telecommunications companies. Since licensee and current ETS lines use the same distribution frame to enter and exit the site, it should be fairly simple to transition to licensee systems. Implementation of this option would require a rulemaking which would be expected to take at least 18 months. Rulemaking would be required because we would establish a requirement for Part 50, Part 70 and Part 76 licensees to provide emergency telecommunications which are currently provided by the NRC. In addition, the options involving licensee provided telecommunications would entail establishing a toll-free number at the NRC Operations Center. This would require changes to all parts of the regulations which establish reporting requirements for voice reports to the Operations Center including the current phone number. Within the rulemaking process, the staff would establish the requirement for licensees to provide ETS and criteria for telecommunications diversity and redundancy. BAH also recommends that a single dedicated line (DAL or foreign exchange) be retained as a back-up. This circuit would be used for the ENS function at each site. GETS and mobile satellite units would also be utilized.

The staff relied on two sources of information regarding the adequacy of licensee communication capabilities. First, the staff considered the conclusions in the BAH report, which were based primarily on visits to Calvert Cliffs and North Anna and discussions with licensee telecommunications engineers at those sites. The staff also conducted an informal survey of nine utilities that have a responsibility for 20 NPP sites concerning their telecommunications system capabilities. The intent of this survey was to gain information concerning telecommunications systems capability for a broader cross-section of NPP sites. The results of this survey are summarized in Attachment 6. In general, the conclusions reached in the BAH study were confirmed by the fact that every site did have at least one alternative to normal commercial telephone lines available to provide a degree of redundancy and diversity.

The adequacy of licensee communication systems, in terms of redundancy and diversity, is also supported by recent events. When a tornado hit the David Besse site on June 24, 1998, the only permanent communications system available was the licensee's corporate microwave system. The NRC's ETS and the licensee's ring down phones used to notify the State and local officials all sustained damage and were unavailable. The loss of communications at Davis Besse also illustrates how telecommunications services at many sites are subject to common mode failure during large scale natural disasters. Consequently, the staff includes an option that would retain DALs or foreign exchange lines for those sites that cannot provide sufficient redundancy and diversity in their telecommunications.

Also, within the mid-term option time frame, the enhanced GETS software program should be implemented for about two-thirds of the sites as described

in Attachments 4 and 5. The advantage of this option is that it does not require rulemaking and is not expected to significantly increase the cost of the existing ETS. The cost of this option is the direct and administrative expense associated with the installation of foreign exchange (FX) lines for about a third of the NPP sites.

A fourth option assumes that the NRC continues to provide a dedicated ETS that consists of FX lines or fixed satellite units. The advantage of this option is that it does not require rulemaking. The major disadvantage is that it is considerably more expensive than the current ETS and does not substantially improve on reliability.

The four options for the mid-term are summarized below in Table 2.

Table 2. NRC Emergency Telecommunication System Mid-Term Options

Option	More or Less Reliable than Current ETS	Rulemaking Required	Cost Relative to Current ETS
Mid-Term (2-3 Years) Option 1	More	Yes	Less
Utility telecommunication systems replace ETS.			
Retain dedicated circuit for ENS.			
Utilize enhanced GETS where available.			
Establish mobile satellite unit at every NPP site.			
Mid-Term (2-3 years) Option 2	More	Yes	Less
Utility telecommunication systems replace ETS where NRC criteria can be met.			
Dedicated circuits retained for those sites that do not meet the criteria.			
Retain dedicated circuit for ENS.			
Utilize enhanced GETS where available. Establish mobile satellite unit at every NPP site.			
Mid-Term (2-3 years) Option 3	More	No	Same
Rely on enhanced GETS for two-thirds of NPP sites.			
Utilize FX lines or DALs for remaining sites. FX lines could be used like DALS or be routed to closest GETS enhanced switch.			
Establish mobile satellite unit at every NPP site.			
Mid-Term (2-3 years) Option 4	Same	No for DALS/FX	Considerably more
Continue to provide dedicated circuits for all emergency telecommunication functions. This could be done with DALS/FX lines or fixed satellite equipment.		Uncertain for satellite equipment	

In analyzing the various options for ETS, the staff weighed the positive and negative aspects of each option. The major factors influencing the staff recommendation are summarized below.

Near-Term Option 1:

Pro: The current system is reliable and fully meets the needs of the NRC incident response program. The cost is expected to remain the same until December 6, 1998, the end date of the current FTS-2000 contract.

Con: This option may prove to be costly following the termination of the FTS-2000 contract. The successful bidder for the FTS 2001 contract may not have a sufficient infrastructure in place to support the ETS without considerable capital expenditures, which would be reflected in higher costs to the NRC. Increased ETS costs would also preclude procurement of portable satellite units.

Near-Term Option 2:

Pro: Provides stopgap system, if necessary, until lower cost mid-term options are implemented. Cost would be maintained at the current level.

Con: Reduces the level of communication between the site and the NRC Operations Center. This would reduce the ability for remote teams (Headquarters Operations Center and Regional Base Team) to provide direct support for the site team.

Mid-Term Option 1:

Pro: This option would transfer the responsibility for providing ETS circuits from the NRC to licensees. The cost of maintaining DAL or FX circuits would be reduced or eliminated from the ETS budget therefore, ETS total cost would be lower than under the current system. This option takes advantage of communication diversity available at many licensee sites.

Con: Not all licensees have an adequate level of redundancy and diversity in their telecommunications systems. Rulemaking required (long lead time). Enhanced GETS will not be fully implemented until 2001. Different communications arrangements at each site.

Mid-Term Option 2:

Pro: Same as Option 1, except that consideration is given to licensee telecommunications systems that are not sufficiently redundant and diverse. This option provides an alternative for licensees who do not wish to invest in an upgrade of their telecommunications systems.

Con: Rulemaking required (long lead time). Different communications arrangement at each site. Enhanced GETS will not be fully implemented until 2001. Net ETS related cost to licensees that do not meet NRC criteria could increase. As the agency's position on a long term strategy becomes clearer and the costs and number of facilities involved in the mid-term strategy are determined, options for providing resources for this option will need to be re-evaluated.

Mid-Term Option 3:

Pro: Reduces the number of DALs and FX lines maintained. Rulemaking not required. Cost is expected to be approximately the same as current ETS cost.

Con: Enhanced GETS will not be fully implemented until 2001.

Mid-Term Option 4:

Pro: Common arrangements at each site.

Con: Potential increase in the cost of DAL or FX service. High cost of installing and maintaining satellite systems would result in ETS costs significantly higher than current ETS cost.

RECOMMENDATIONS:

The staff recommends that the Commission:

1. approve the staff proposals as stated above for Near-Term Option 1;

2. approve the staff proposals as stated above for Mid-Term Option 2;

3. direct the staff to commence the rulemaking procedures which will require the licensees that meet the NRC criteria to support all ETS circuits (with the exception of ENS) beginning in the Year 2000; and

4. note that the staff will continue to review the evolving telecommunications industry products and services in order to provide cost-effective emergency telecommunications.

RESOURCES:

AEOD's budgeted resources for FY 1998 through FY 1999 are adequate to support the cost of continuing DAL service (including the new Universal Service Fund charge), provided that there is not a substantial increase in the cost of DAL service following the termination of the FTS 2000 contract. The potential exists, however, for a significant budget impact beginning the second quarter of FY 1999 due to the uncertainty of post-FTS 2000 DAL service costs and service transition costs. The adequacy of the resources budgeted for FY 2000 and beyond will depend on how timely Mid-Term Option 2, or other low cost options, can be implemented. Since satellite-based communication technologies continue to rapidly change, specific resources for procuring mobile satellite equipment for NPP sites has not been identified or included in the current budget. (The AMSC satellite equipment recommended in the BAH study currently costs about $1500 per unit.) However, funding for purchasing or leasing mobile satellite equipment will be reprogrammed from within AEOD's budget as utilities become responsible for their own ETS circuits, allowing the NRC to reduce the number of NRC funded DALs. All technology decisions required to implement Commission guidance on this issue will be reviewed through the agency's Capital Planning and Investment Control Process. The anticipated resources for Rulemaking would be 1.4 FTE for 18 months. This includes about 0.6 FTE of support from OGC, OCIO, and ADM. An estimated $20K in contract support for Regulatory Analysis could be required. It is expected that AEOD would reprogram internally for the costs of rulemaking if directed to pursue an option requiring rulemaking.

COORDINATION:

This paper has been coordinated with the internal incident response stakeholders including NRR, NMSS, and the Regional Offices. The Office of the General Counsel has no legal objection to this paper. The Office of the Chief Financial Officer has no objection to the resource statements contained in this paper. The Office of the Chief Information Officer has no objection to the information technology or telecommunications needs discussed in this paper.

L. Joseph Callan
Executive Director for Operations

Attachments:
1. Simplified ETS Diagram
   V. Stello Memorandum Dated September 12, 1988
2. Booz-Allen & Hamilton Study, "Assessment of the Emergency Telecommunications System, " Dated August 20, 1997
3. GTE Government Systems Preliminary Assessment, Government Emergency Telecommunications Service Application in the NRC
4. Emergency Telecommunications System
   Background Information Concerning NCS, GETS, and TSP
   NRC Staff Survey of 9 Utilities
5.
6.

ATTACHMENT 5

National Communication System (NCS) Services

- Government Emergency Telecommunication Service (GETS)
- Telecommunication Service Priority (TSP)

Although the public switched network (PSN) is both reliable and robust, during periods of stress or extremely high call volume (or both) concern is highest for being able to receive dial tone and complete a call through the local exchange telephone switches. Use of direct access lines (DALs) in conjunction with the Federal Telecommunications Services (FTS) network has minimized this concern. However, new technologies are now available to help ensure calls are completed.

Over the last year, the staff has worked extensively with the National Communication System (NCS) for the purpose of exploring new methods for ensuring call completion during an emergency. NCS was created by President Kennedy following the Cuban missile crisis to provide better communications support to critical government functions during emergencies. NCS' responsibilities with regard to coordinating and planning National Security and Emergency Preparedness (NS/EP) telecommunications to support crises and disasters were expanded under President Reagan in 1984. One of the major programs sponsored by NCS is the Government Emergency Telecommunications Service (GETS).

The major features of GETS are enhanced routing and priority treatment in the use of long- distance and local telephone networks to ensure a high probability of call completion, even if the PSN is highly congested. GETS has recently been used successfully during the following emergency situations:

- In 1995, the U.S. Department of State used GETS to successfully contact the U.S. Consulate in Kobe, Japan, following a devastating earthquake.
- A Federal Emergency Management Agency (FEMA) field office in Tallahassee, Florida used GETS to contact utility companies regarding power outages during Hurricane Opal.
- In 1996, the Army used GETS to make the first successful public network telephone call to the island of St. Croix during Hurricane Bertha to advise personnel of inbound helicopters.

NRC has also used GETS during emergency preparedness exercises. In general, GETS has not worked reliably from pay phones at airports or hotels because the local telephone switch may not be programmed to accept GETS. However, in situations where the local telephone switch is associated with a regional Bell operating company (RBOC) or a major independent telephone company, the experience with GETS has been very good. NCS is in the process of working with the RBOCs and the top 25 independent telephone companies to provide GETS enhancement software that will substantially increase the probability that a GETS call will be completed during periods of network congestion. The GETS enhancements are scheduled to be completed for the three principal switch types in FY 2001. The current expectation is that when the GETS enhancement is complete throughout the call path, the probability of a blockage during a condition of extreme congestion (8x normally engineered traffic) would be on the order of 10E-6.(2)

At the request of the NRC, NCS conducted a preliminary assessment of whether GETS could be a viable alternative to the DALs. The study concluded that GETS enhancements are scheduled to be installed in all of the switches in the PSN call path from the nuclear power plant (NPP) to the NRC Operations Center for about two-thirds of all NPP sites. Thus, for these sites, scheduled GETS enhancements will provide for a viable alternative to the DALs. For the remaining sites, foreign exchange (FX) lines could be run to the nearest switch that is scheduled for GETS enhancement. The NCS study estimated that the annual recurring costs associated with the implementation of this approach would be comparable to the current costs of DAL service.

Additionally, there is a NCS-sponsored program called the Telecommunications Service Priority (TSP) System. This program provides for either priority provisioning or restoration of national security/emergency preparedness (NS/EP) telecommunications circuits. Under the provisioning feature, priority installation can be requested for new service needed to respond to an emergency or to relocate and resume operations after a disaster. The TSP restoration feature only applies to existing service and requires service providers to restore TSP circuits as soon as possible after an outage.

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1. On August 24, 1992, Hurricane Andrew passed directly over Turkey Point, causing a loss of all communication between the site and the NRC for

approximately 3.5 hours. This was followed by intermittent communications using FM radio and a cellular telephone. Reliable communication was restored approximately 28 hours after communications were lost when a portable satellite telecommunication unit from the National Interagency Fire Center was installed at Turkey Point.

2. Eight times normally engineered traffic represents an extreme congestion condition. The Oklahoma City bombing resulted in about 4x normally engineered traffic.