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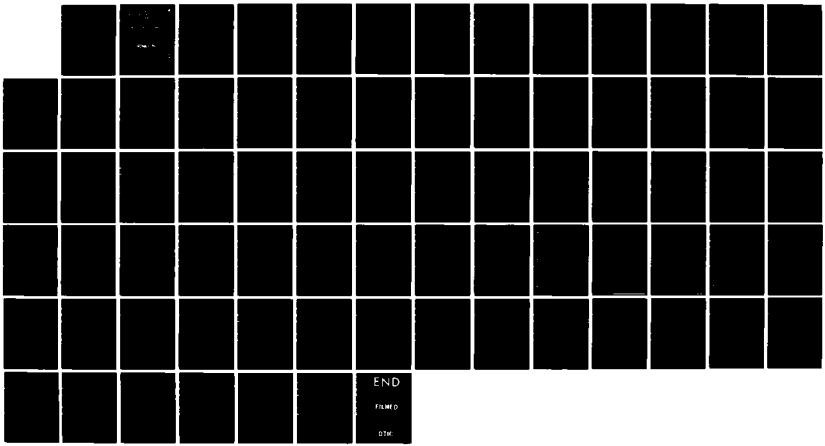

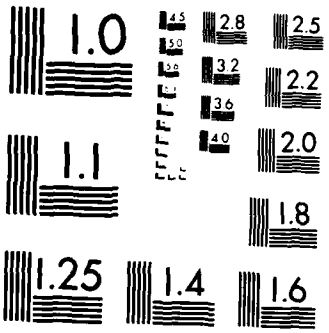

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JOINT DOD/DOE NUCLEAR WEAPONS ACCIDENT EXERCISE (NUWAX-81)

AD-A149 414

AFTER ACTION REPORT

VOLUME I – EXECUTIVE SUMMARY

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FIELD COMMAND, DEFENSE NUCLEAR AGENCY
KIRTLAND AFB, NEW MEXICO 87115

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FC 28 August 1981

SUBJECT: Joint Department of Defense/Department of Energy Nuclear Weapons Accident Exercise 1981 (NUWAX-81) After Action Report

SEE DISTRIBUTION

1. Attached is Volume I, Executive Summary, of the NUWAX-81 After Action Report. The Executive Summary includes the major lessons learned, recommendations for improvements, and a summary of current initiatives concerning nuclear weapons accident response.

2. Volume II of the NUWAX-81 After Action Report will include the contents of Volume I as well as additional detailed comments regarding the exercise. Volume II is intended for use by those individuals whose duties involve nuclear weapons accident responsibilities. It includes the lessons learned portion of the major participants' after action reports.

3. Additional copies of Volume I and/or Volume II of the After Action Report may be obtained by writing Commander, Field Command, Defense Nuclear Agency, ATTN: FCPE, Kirtland Air Force Base, New Mexico 87115. Further information concerning the After Action Report, nuclear weapons accident response, and/or nuclear weapons accident exercises is available at the above address or by contacting the Joint Nuclear Accident Coordinating Center at AUTOVON 244-8470 or 244-8279.

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SECTION A

OVERVIEW

1. BACKGROUND:

a. A joint Nuclear Weapons Accident Exercise, NUWAX-81, was conducted during the period 21-26 April 1981. This paragraph puts the exercise into perspective relative to the evolution of the national capability to deal successfully with a nuclear weapon accident.

b. In 1966 at Palomares and 1968 at Thule, the Departments of Defense (DOD) and Energy (DOE) gained extensive experience in procedures and techniques for recovering from an actual nuclear weapon accident. As a result both organizations, by the late 1960s, had perfected procedures and capabilities to high levels of readiness. Nevertheless, the national response forces of the time had not dealt with an accident in an urban or semi-urban area of the continental United States or in settings where large numbers of civilians were present. In addition, knowledge of nuclear accident procedures within the DOD was not uniform since the USAF was the Service which had gained the bulk of the field experience.

c. As a result of improved procedures and better design, the probability of a nuclear weapon accident was reduced during the 1970s and none occurred during this period. Successful accident prevention over such a long period slowed the rate of improvement in national response capabilities. There was less motivation to continue advances in conceptual thinking, planning, organization and joint training. Concurrently, the experience base gradually eroded as experienced personnel left the Services or were reassigned to other duties. However, nuclear weapons, of necessity, continue to be exposed to operational situations wherein the potential for an accident is present. In recognition of the lower level of preparedness that evolved in the 1970s and the continued, though lowered risk of accidents, and taking note of the benefits the British had gained from a formal series of nuclear accident training exercises, the Assistant to the Secretary of Defense (Atomic Energy)

(ATSD(AE)) directed and sponsored a prototype DOD/DOE nuclear weapons accident field exercise, NUWAX-79. The exercise was conducted in April 1979 at the DOE Nevada Test Site. Coincidently, the Three Mile Island (TMI) reactor accident in March 1979 heightened public concern about nuclear accidents and reinforced the wisdom of the DOD/DOE decision to conduct a field exercise involving a live radioactive contaminant.

d. NUWAX-79 was a time-compressed exercise of limited scope. It did, however, involve the DOE and all four Services in order to increase accident response awareness throughout the DOD. Play in the Washington area was minimal, as were off-site communications and interfaces with other federal departments and agencies which might have direct or supporting responsibilities. No attempt was made to include state or local authorities. This limited approach to improvement of the national nuclear weapon accident response capabilities reflected then-existing perceptions of current capabilities and what was initially achievable. The approach proved to be prudent, for the new Federal Emergency Management Agency (FEMA) was concentrating its attention on the management problems arising from the TMI event.

e. Considered within the context of its scope and intent, NUWAX-79 was a very successful exercise, since no comparable exercise of its magnitude had ever been attempted in the United States, and no actual nuclear weapon accident had occurred for over eleven years. The true significance of NUWAX-79 was its clear highlighting of what had to be done to regain the capabilities that had previously existed and expand them to meet more demanding conditions. The exercise planning process alone made it obvious that a nuclear weapon accident will create unique radiological health hazards, public concerns and clean-up problems far different from other military or natural accidents that might involve military response. During the field exercise proper, it became clear that effective management of the response efforts required uniquely knowledgeable and well-trained military commanders and staffs to meet the

specialized, multifaceted technical and operational challenges. Furthermore, exercise experience confirmed that the capabilities and support available from or provided by DOE participants were neither widely understood nor well defined in DOD Service directives. Consequently, DOE capabilities were poorly integrated and less than efficiently utilized, and DOE responsibilities were not initially recognized by the DOD on-scene commanders.

f. Following NUWAX-79, many improvements were made. Intra-DOD and interagency agreements, directives and procedures were developed or refined. The roles and responsibilities of FEMA were integrated into DOD and DOE planning. A draft Nuclear Weapons Accident Response Procedures manual was prepared as a guidance document for field use by DOD and other accident response forces. Training programs were revised at the Interservice Nuclear Weapons School, and a new senior officers' course was initiated. Steps were taken to involve state and local governments in nuclear weapon response activities and exercises. In September 1980, a TITAN accident (Damascus, Arkansas), which involved a nuclear weapon but not radioactive dispersion, stimulated further DOD improvements. A major advance up the learning curve came when the Chairman of the Joint Chiefs of Staff directed that a major command post exercise (CPX), PREMIER TASK III, be held in February 1981. This CONUS-only CPX exercised the actions and interface procedures that would occur at the DOD, DOE and FEMA operations centers in the Washington area. Thus, the many improvements resulting from NUWAX-79, the real accident in September 1980, and PREMIER TASK III set the stage for NUWAX-81, the next major step toward achieving greater national capability to respond to a nuclear weapons accident.

g. The purpose of NUWAX-81, the tasking for which had been given to DNA by the ATSD(AE) in 1979, was to build and expand upon the advances made since NUWAX-79. Major goals included involvement of federal, civil and military headquarters and their field response activities. Further, NUWAX-81 was intended to involve a state

emergency response organization and, insofar as practicable, to simulate local government and civilians in the accident environment. Initial planning efforts considered holding the exercise at a different location from NUWAX-79. This was to try to achieve a more urbanized and less remote accident locale and also to ease the burden of billeting the requisite support forces. However, the value of using a live radioactive contaminant for realism and the lack of an alternate area with a suitable Environmental Impact Statement (EIS) dictated a return to the Nevada Test Site. In NUWAX-79 the U.S. Army provided the Initial Response Force (IRF) and the USAF provided the Service Response Force (SRF). The roles were reversed in NUWAX-81. This expanded the experience of both Services and permitted an evaluation of the role played by Army's Director of Military Support (DOMS), who is responsible for supporting FEMA should the President declare a state of domestic emergency following a nuclear weapon accident. This provides the context for the specific objectives and conduct of NUWAX-81.

2. OBJECTIVES:

a. The major exercise objectives were:

(1) Exercise the participation of local, state, and federal agencies in the planning and conduct of the exercise. Evaluate the interface of the accident response elements with these agencies.

(2) Exercise the command and control of the joint DOD/DOE accident response organizations. Evaluate their effectiveness in accordance with current directives and the procedures set forth in the previously prepared and distributed draft Nuclear Weapon Accident Response Procedures Manual (NARP).

(3) Evaluate the coordination and utilization of technical and logistical support available to on-scene elements from initial response through site restoration during a nuclear weapons accident.

(4) Validate the concept and implementation of a Nuclear Weapon Accident Response Procedures Training Package (NARPTP) developed by Field Command, Defense Nuclear Agency (FCDNA). This training package is designed to enhance the preparedness of on-scene commanders and their staffs to respond to nuclear weapon accidents.

3. EXERCISE PLANNING:

a. Joint planning for NUWAX-81 commenced in September 1979 with the first meeting of the exercise planning group held at FCDNA 24-25 September 1979. Planning responsibilities were assigned to two major sub groups, the Exercise Operation and Evaluation Working Group and the Technical Scenario Working Group. The two groups were composed of action officers/representatives from the Services, DOD, DOE, Federal Emergency Management Agency (FEMA), and State of California Office of Emergency Services (CAOES).

b. The deciding factor in the selection of NTS as the exercise site was the availability of an approved Environmental Impact Statement (EIS) which permitted use of a radioactive contaminant. Another major advantage NTS had over many other federal installations was its remote location which minimized the likelihood of public alarm or reaction to the use of a radioactive contaminant and permitted close control over exercise events and avoided adverse impact on other military and civil activities.

c. Two major planning documents were published by Field Command, Defense Nuclear Agency for use by exercise controllers and players. The NUWAX-81 Exercise Plan (EXPLAN) provided detailed information for the planning, preparation, execution, and analysis of the exercise. The NUWAX-81 Player Supplement to the EXPLAN provided the player response forces necessary information about the exercise to help minimize exercise artificialities and satisfy real-world safety concerns. In some cases, exercise play indicated a regretable unfamiliarity with the player supplement on the part of some participants.

4. EXERCISE SCENARIO: A U.S. Army CH-47 helicopter with nuclear weapons on board was enroute from an Air Force Base in the continental United States (CONUS) to an Army depot to return three nuclear weapons and six limited life components. The weapons had been transported by a United States Air Force (USAF) C-141 aircraft from United States Army, Europe (USAREUR) to a CONUS Air Force Base for further transfer by C-130 aircraft to an Army depot air field. A temporary grounding of the C-130 aircraft resulted in authority being granted for movement of the weapons from the Air Force Base to the Army depot by Army helicopter. This exercise artificiality was necessary to justify the Army Service Response Force (SRF) participation. During the flight, the transport helicopter suffered a midair collision with a civilian light aircraft and both crashed on farmland near a small rural community. The helicopter exploded upon impact and burst into flames. A subsequent high explosive detonation spread radiological contamination over a large area. The helicopter aircraft crew and civilian pilot were killed upon impact. Several civilians in the immediate vicinity of the crash were severely burned and contaminated. Notification of the accident emanated from a "mayday" report from the helicopter pilot, transmitted just before impact, and from civilian observers on the ground. The nearest military installation and the state office of emergency services were notified, and an exercise OPREP-3/PINNACLE "Broken Arrow" message was submitted to the National Military Command Center (NMCC). The Joint Nuclear Accident Coordinating Center (JNACC), headquarters DOE, and FEMA were subsequently notified, and appropriate Service/agency response forces deployed to the accident site.

5. EXERCISE OPERATIONS:

a. NUWAX-81 was a fast paced exercise that provided challenging accident recovery problems to on-site response forces and remote operational centers under realistic conditions. A Joint Task Group (JTG) composed of approximately 400 personnel, provided exercise control, evaluation, and support both at the Nevada Site and at Emergency Operations Centers (EOC) in the Washington area. JTG umpires

functioned as both exercise controllers and evaluators, and were employed on-site and at 22 remote locations.

b. Some 770 player participants representing the DOD, DOE, State of California, FEMA and other Federal agencies responded to the accident. A player base camp, established at the accident scene prior to exercise commencement, provided billeting and messing support for the response teams. The base camp was under the operational control of the Service Response Force on-scene commander. The artificiality of establishing the base camp in advance of STARTEX was accepted in the interest of exercise efficiency.

c. The exercise commenced from a staged setting with the first players to arrive being state regional law enforcement and transportation officials. [illegible] their arrival, the exercise quickly transitioned to a "free play" mode. Control implementers were required infrequently to provide an input to the exercise that would not reasonably be expected to occur under exercise conditions. Appendix 2 to Section C, NUWAX-81 Recovery Operation Flow Network, provides a visual display of key exercise activities and events.

d. There were 127 official visitors (including news media personnel) who observed NUWAX-81 operations on the third day of the exercise. In addition, there were 87 official observers, including foreign observers from the United Kingdom and Australia, who attended the exercise for periods ranging from four to six days.

6. LESSONS LEARNED AND RECOMMENDATIONS:

a. The major lessons learned from NUWAX-81 and recommendations regarding accident response are included as Section B to this Executive Summary. They comprise the results that are considered to be the most significant in the context of upgrading our national nuclear weapons accident response capabilities. Agreement as to the major lessons learned was achieved through two coordination conferences conducted at Headquarters, Defense Nuclear Agency (HQDNA) in June 1981. The first conference was a three day meeting attended by key Joint Task Group (JTG) and player

representatives; the second was a one-day conference attended by general officers and federal/state agencies senior management personnel. Also included are lessons learned which in the opinion of the DNA, the Agency conducting the exercise, are of sufficient importance to be included herein.

b. The lessons learned and accompanying recommendations contained in the text of Volume II, Joint DOD/DOE NUWAX-81 After Action Report, published separately include lessons learned from Section B, this volume, and additional lessons learned which are also very important. These additional lessons learned represent the views of HQDNA, the Exercise Control Staff and player personnel who were involved in exercise activities. These lessons learned and recommendations should be of special value to those organizations which have specific responsibilities. A separate administrative after action report; prepared for limited distribution, addresses the planning for a nuclear weapon accident exercise and identifies planning lessons learned.

7. SUMMARY OF NUWAX-81:

a. Overall, NUWAX-81 must be considered a success. The objectives of the exercise were achieved and new lessons were learned. Previously developed solutions were verified and a greater awareness was aroused in the federal and state governments about the need to develop and practice nuclear weapon accident response. NUWAX-81 was an excellent test-bed for the new directives and agreements that grew out of NUWAX-79. The evaluation of the draft Nuclear Weapons Accident Response Procedures (NARP) manual revealed that the NARP concept is valid and can be used successfully by Service and federal response forces as a guidance manual for planning and operations.

b. There was unanimous support from both planners and players for continuing the NUWAX exercise series. NUWAX-81 confirmed the NUWAX-79 experience that only through jointly conducted field exercises can the degree of realism be achieved that allows for a critical test and evaluation of current nuclear weapon accident response procedures and doctrine. NUWAX-81 also showed the great value to be gained by the

periodic play of Command Post Exercises. The benefit of the Washington CPX PREMIER TASK III to the conduct of NUWAX was clearly evident. Also evident was the validity of the requirement for the self-contained Nuclear Weapons Accident Response Training Package (NARPTP) now being developed by FCDNA for Initial Response Force (IRF) and Service Response Force (SRF) team training. This training package will provide Service Response Force commanders and their staffs with a valuable training aid that can be exercised locally as required to maintain staff proficiency. Greater utilization of these training packages and CPX training should be made in the future.

c. NUWAX-81 was a learning experience of great benefit to the response community. It was conducted in a no-fault environment and thus has permitted a complete and very candid evaluation in this After Action Report. There is no intention to single out individuals or groups for criticism; the objective is to improve response planning and procedures. In fact, individual and group performance should be highly commended. The leadership demonstrated in the response clearly reflected extreme dedication and sense of purpose.

d. Special pre-exercise training in both field activities and emergency operations centers raised the level of participants' awareness and performance. While this training contributed to the success of the exercise, it also masked somewhat the confusion that would occur in a real accident situation. In the real world, actual press representatives, more senior officials, on-duty operations teams, FEMA/state/local officials, and probably the White House, Congress and the State Department, would all provide a more demanding environment. Communications could have been a severe rather than bothersome problem. The need to provide rapid and accurate situation reports to these important officials will further tax the various accident response cells and the coordination among them. The participants trained with and tested a number of draft documents intended to supplant current directives, regulations and agreements that were out of date, incomplete or inconsistent. There was much benefit from testing these revised documents, but

since the drafts have not yet been widely distributed, the individual performances in NUWAX-81 are probably not representative of the accident response community as a whole. While work continues to refine directives, training and the assignment of nuclear weapon accident responsibilities among the various interes. agencies, there is a clear need to move more swiftly. There will be no pre-accident training for the real event as there was for NUWAX-81.

8. RECOMMENDATIONS FOR NATIONAL RESPONSE IMPROVEMENTS:

The phased progress in increasing our national capability to respond to a nuclear weapon accident has been extensive. NUWAX-81 was a significant advance over NUWAX-79 with many lessons learned and applied. Nevertheless, there remain several opportunities to further enhance the National response capability. These include:

a. US Navy On-Shore Experience: The Navy has not had the opportunity to exercise in a joint NUWAX exercise its on-shore nuclear weapon accident response capabilities or the interfaces with other Federal Departments/Agencies and state and local governments. This circumstance will be corrected when the Navy plays the major Service response role in NUWAX-83.

b. Radiological Guidelines: The absence of agreed radiological guidelines to assist the field forces in a radioactive recovery operation following a nuclear weapon accident remains an area of weakness. While there is guidance for what equipment is needed for DOD and DOE personnel protection, there are no agreed federal radiological recovery guidelines for FEMA or the on-scene commander to use with state or local government officials or with the civilian community surrounding an accident site. The public information and relations programs are also hampered by a lack of radiological guidelines. It is not hard to forecast the challenges facing the total federal response force under the existing conditions. Examples of these challenges include:

(1) The need to assure contaminated civilians that they have been properly decontaminated.

(2) The need to achieve agreement with state and local agencies that buildings, land, etc., have been cleaned up to a level of safety that has broad support among the scientific community. In the absence of some agreed criteria, the economic impact and legal aspects could be overwhelming.

(3) The need to contain public alarm during all phases of initial response through final recovery.

These challenges are predictable because the problems and uncertainties have been raised after each actual nuclear weapon accident and in both NUWAX exercises. They also were present at the Three Mile Island accident. After an extensive period of ad hoc negotiation, agreed radiological standards for the specific incidents were established. However, because of the extreme press and public agitation that can be expected after a CONUS nuclear weapon accident, prior development of agreed guidelines is very important. The Federal Government's foresight and credibility will be challenged in the absence of agreed guidelines. There has been extensive work toward developing guidelines for some kinds of radioactive dispersal, but no federally agreed, universal guidelines have been adopted. Without doubt, the precise degree of hazard for every level of radioactive isotope dispersion is difficult to determine; nevertheless, the risk of an accident is always present and the issue must be addressed. Protracted deliberations after the accident could endanger the public and undermine confidence in federal, state and local government. It should be noted that absolute standards are not recommended herein. Other agencies have recommended that such standards be established. This may be the ultimate solution, but because of the difficulty in predicting radiological effects under all accident conditions, attempts to establish absolute standards may be impossible. For this reason it is believed the first effort should be slanted toward formulating guidelines.

c. Federal, State and Local Planning: For the first time, NUWAX-81 incorporated state and local authorities in a major nuclear weapon accident exercise.

NUWAX-81 experience reaffirmed the necessity for emergency pre-planning and coordination between DOD nuclear facility commanders and civil authorities. Prompt, effective, coordinated reaction will depend on the degree of pre-planning and mutual knowledge of responsibilities and capabilities established prior to an accident. The complexities of the response required, the initial confusion resulting from inadequate information flow, the hazards to life and the threat of radioactive contamination all demand coordinated pre-planning.

Since NUWAX-79, DOD, FEMA and DOE have been striving to improve coordination with local and state authorities. DOD has directed that the Services cooperate with and assist FEMA in developing radiological emergency plans with appropriate state and local authorities for those DOD fixed facilities where the potential exists for an accident involving radioactive material. Local military installation commanders must plan to coordinate or interface with state and local officials during radiological accident exercises within the limits permitted by security classification guidelines and the ability of the local governmental agencies to participate. The basic DOD policy of "neither-confirming-nor-denying" the presence of nuclear weapons under normal day-to-day conditions constrains accident pre-planning and joint military/civilian exercises. Nevertheless, there is a need for some form of military-civil government interface to take place. Actions are in progress to resolve the dichotomy between security requirements and the need to enhance nuclear weapon accident coordination. It is imperative that military installation commanders be provided clear guidance and assistance that will enable them to plan effectively with their civilian counterparts.

In recognition of the need stated above, a draft joint DOD/FEMA nuclear weapon accident planning document for military, local and state authorities is now being coordinated. When accepted by both agencies this document will provide a framework for conceptual planning of response activities and exercises to support a coordinated nuclear weapon accident response. While the form and implementation of

DOD's "neither-confirm-nor-deny" policy has a major effect on the joint DOD/FEMA planning document, the document nevertheless fills an important need. Recent DOD relaxation of the "neither-confirm-nor-deny" policy to give more local latitude under accident conditions has been a very useful step. The effort to prepare and coordinate the DOD/FEMA nuclear weapon accident document has had the positive effect of producing greater understanding of the complexities of a nuclear weapon accident throughout the federal establishment.

Within the DOE, work has been undertaken to rewrite the Interagency Radiological Assistance Plan (IRAP). The new Federal Radiological Monitoring and Assessment Plan (FRMAP), which replaces the IRAP, will update and integrate DOE's radiological assistance responsibilities and clarify DOE's responsibilities to FEMA and state/local governments.

In summary, considerable work is under way to clarify and document DOD, DOE and FEMA responsibilities to state and local governments and the citizens who reside near DOD nuclear-capable installations. These efforts must go forward rapidly and have full executive support in all branches of government so that the vital planning of federal, state and local actions before and after a nuclear weapons accident can proceed effectively.

d. Overseas Improvements: Through the completion of NUWAX-81, emphasis in developing nuclear weapon accident capability has employed CONUS scenarios. It was decided that if planning were concentrated first on CONUS the knowledge gained could be transferred expeditiously overseas. To do otherwise would have fragmented the incremental improvement approach necessitated by the limited resources of experienced staff.

After NUWAX-79 and -81, the lessons learned were briefed at EUCOM, USAREUR, USAFE and other overseas headquarters. The Interservice Nuclear Weapons School has taught several courses to commanders and staffs overseas. Observers from overseas commands attended both NUWAX field exercises. Individual overseas commands have

taken steps within their areas of responsibilities to improve their response capability through various types of training exercises. Nevertheless, more can be done to achieve the fully integrated response capability that is evolving in CONUS.

Extensive consultation with the Department of State and local US embassies is required to coordinate US efforts overseas. It is clear that an overseas accident will involve the US embassy to the fullest. Early establishment of interface and mutual training is essential and has not taken place in all cases. Peculiar aspects of response within each nation that result from local status-of-forces or other bilateral agreements should be identified, and advance coordination with host military and civilian authorities should be accomplished. US and host capabilities need to be blended for a coherent plan and a capable response force. Single-Service and then joint training and exercises should be undertaken. An overseas version of the NARP should be developed with sections tailored to the local conditions existing in each country that might become involved. The heightened awareness that exists in various overseas commands and within the JCS can be expected to assist in furthering the development of better overseas capabilities. Current planning for future NUWAX exercises provides for overseas exercises.

e. Training of Senior Officials: Very few senior military and civilian authorities with direct nuclear weapon accident responsibilities have received formal training in the complexities of accident response. A larger number have some knowledge of the lessons learned in the various accident exercises. A two-day Flag/General Officers Nuclear Accident Course (FONAC) is conducted by the Interservice Nuclear Weapons School (INWS) at Kirtland AFB. This course has received high praise but limited flag officer and senior civilian attendance. Designed for on-scene commanders and their senior staffs, the FONAC can help appropriate commanders or their civilian counterparts in FEMA or state governments achieve a major increase in their knowledge of nuclear weapon accident response. As a result of the lessons learned and interest generated by NUWAX-81, a course of instruction is

being prepared jointly by DNA and the INWS for presentation to senior civilians and military decision makers in the Washington area. The first course will be given in early calendar year 1982.

f. Expansion of Training Opportunities: Ever since the preparatory planning for NUWAX-79, numerous recommendations for revisions of regulations and operating procedures have been made. The efforts toward refinement and improvement have resulted in the draft NARP, new formal courses of instruction and many revisions of DOD operating procedures. Lessons learned from exercises have been briefed widely. Nevertheless, knowledge of the many challenges facing accident response forces and the recommendations on how to manage these forces have had limited dissemination within the individual Services. While those senior individuals who participated in NUWAX-79 and -81 are now much more capable of responding effectively to an accident, the experience level throughout DOD is extremely limited. Retirement and transfers continue to drain the cadre of experienced officers and senior civilians. Since the probability of having an accident is low, it is, perhaps, understandable that even those individuals who are tasked by their services to respond to an accident tend to downplay this responsibility and focus almost exclusively on the many day-to-day problems facing them. The limited accident knowledge and experience evident in the response forces was recognized in the After Action Report of NUWAX-79. As a consequence the OJCS directed a DNA/Service review of accident response force philosophies and organizations to determine if there are better methods of providing more highly trained accident response forces on short notice. This review has been completed and is now being staffed by the Services. Early action to implement the recommendations is needed. Key to improvement is the designation of a limited number of response forces so that those so designated will recognize the priority of the response mission and train accordingly.

Methods are needed also to exercise the on-scene commanders and their senior staffs at their organizational locations without the expense of major field exercises which involve high cost and disruptive travel. With this in mind the

Commander of Field Command DNA, with DOE assistance, has designed and is now field testing the Nuclear Weapons Accident Response Training Package (NARPTP) that can be used at the installation level to exercise the conceptual thinking and management decision process of response forces. Many different scenarios with varying degrees of complexity are available in the self-contained package. If field tests of this concept prove successful and show its usefulness to unit commanders, the training package will be made available in suitable numbers to the individual Services.

g. Logistics Support: NUWAX-79 and -81 were both conducted in remote areas. While it can be argued that the probability of a nuclear weapon accident is higher on or near a military installation, the decision to hold the first two field exercises off installations appears to have been sound. After a long period without real or simulated accident experience (1968-1979), it was reasoned that a graduated, incremental approach to overall improvements was necessary. Also, it was believed that an on-installation NUWAX-79 scenario was probably exercising DOD's greatest strength and that more rapid improvements could be made if the exercise were held away from the ready assets of an existing base. Other factors that led to an off-installation exercise were the desirability of a live radioactive contaminant and the inability during the planning for NUWAX-79 to find a suitable operating installation with an accommodating EIS. Finally, the NUWAX-79 planners reasoned that DOD and DOE were not prepared to accept the extensive public objections that might arise from communities adjacent to an on-installation accident exercise.

The wider scope of NUWAX-81 -- with participation by FEMA, other federal agencies and the California Office of Emergency Services in the field, by the headquarters of DOD, DOE and FEMA and various other federal agencies in Washington, and with the DNA Joint Task Group control staff members simulating local townspeople and government -- was a major advance in exercising a more complex scenario. Since the technical problems of damaged weapons had received high emphasis in NUWAX-79, somewhat less attention was given to the weapons recovery process in NUWAX-81. However,

the weapons recovery operation did identify some problems and provided valuable training. The problems of controlling and dealing with the spread of radioactivity both inside and outside a National Defense Area were emphasized. This was particularly useful for FEMA and state participants. To do this realistically a live contaminant was dispersed, once again forcing the use of the Nevada Test Site for NUWAX-81. While there are many obvious advantages to using the Nevada Test Site for NUWAX exercises, one clear disadvantage is its remote location and limited logistic support.

Though a nuclear weapon accident in a remote area is not the most likely event, history has demonstrated that such accidents can occur. For this reason, the NUWAX-81 planners initially intended exercising the short-notice response of logistics forces to support a remote-area accident. Unfortunately, this goal was precluded by constraints on funding and the limited time available for an exercise. The After Action Report of NUWAX-79 had highlighted the exercise artificiality of having a pre-established base camp to support accident response forces. Consequently, DNA had recommended to the JCS that a pre-designated logistics package be identified. Initial Service reaction to the recommendation was non-supportive on the grounds that all Services had organic logistics personnel and supplies rapidly available and, therefore, that pre-designation was not required. The NUWAX-81 planners found that although the Air Force maintains a mobile logistics package that would be suitable for CONUS deployment (HARVEST EAGLE), the Army does not. The lengthy pre-planning and pre-exercise actions necessary to assemble and deploy the Army base-camp support would have severly hampered the response force commander. Little is known at this point about the Navy's ability to support an accident response force in a remote area.

In summary, it was demonstrated in NUWAX-79 and -81 and in the Palomares accident that a large base-camp is required to support a remotely located accident response force and that the assembly of such a camp is time-consuming. Although base-camp

support could logically come from any Service or Service combination, NUWAX-81 showed the need for a pre-planned, air-transportable logistics package for use in the CONUS by any service response force. If the pre-designation issue is resolved, it is recommended that a future NUWAX involve real-time play by both the accident response force and the logistics support at a remote accident.

h. Joint Long-Range NUWAX Planning: The obvious success of NUWAX-79 and -81 and the benefits derived from each exercise have resulted in an improved National capability to respond to a nuclear weapon accident. This progress needs to be sustained through a formal program management programming plan to direct and guide the needed improvements in the entire federal establishment. Such a program will provide a means whereby the capabilities of responsible agencies can be honed, new doctrine and procedures can be tested and refined, and high-level officials can be kept aware of the impact and consequences of a nuclear weapon accident. A formal coordinated management programming plan should include the many interrelated improvements which are necessary and will serve as a clear sign of National commitment to improving response performance and monitoring progress through a schedule of realistic exercises. Furthermore, goals, priorities and milestones need to be established to guide Department of State actions in coordinating with those governments where US nuclear weapons are located.

Recognizing the totality of the situation, the Assistant to the Secretary of Defense for Atomic Energy (ATSD(AE)) has directed the DNA in conjunction with the JCS to carry out a ten-year program of nuclear weapon accident exercises. The program envisions annual joint command post exercises (CPXs) and a joint field training exercise (FTX) in each odd year. These exercises are to be sufficiently large as to involve the entire federal response. The tasking includes both CONUS and overseas exercises. The ATSD(AE) tasking regularizes the DOD NUWAX program, justifies budgetary planning, and creates a framework for continued progress.

In addition to the ATSD(AE)) tasking, the Chairman of Joint Chiefs of Staff has added his support and has tasked the JCS J-3 to prepare a program of short mini-CPXs for use by the NMCC and Service command centers.

In addition to these DOD initiatives, it is necessary that complementary actions be taken within other parts of the federal government. The Department of Energy already has a comprehensive nuclear accident response program that has played a key role in the NUWAX exercise series. The ongoing NUWAX program will include DOE as an essential partner.

A document similar to the Nuclear Accident Response Procedures manual (NARP) is needed to cover the actions of FEMA and other federal agencies that will become involved should a nuclear weapons accident occur. FEMA has indicated that it is FEMA's responsibility to develop such a document, and work to that end has begun. However, mere preparation of a federal NARP along the lines of the DOD NARP will not be sufficient. The various government agencies that will participate in a nuclear weapon accident response must achieve the requisite level of readiness through training, acquisition of required material assets, and by budgeting the funds necessary to sustain their capability.

In summary, a plan and milestones to integrate the federal, state and local government agencies into a fully capable response force needs to be developed. The Department of Defense and its agencies will play a big role in such an effort but cannot do the job alone. The US Federal system requires that civil agencies conform to and support an overall plan. The sponsor of this plan has not yet been designated. This should be addressed as a priority matter in order that a civil response plan be available for testing in NUWAX-83.

i. Summary of Current Initiatives: In the final analysis, many actions for improving nuclear weapon accident response capabilities are under way.

(1) Broad Policy Questions.

(a) A DOD directive clarifying the "neither-confirm-nor-deny" policy and the operation of the Joint Information Center is in final coordination.

(b) Legal authority for establishing and controlling the National Defense Area (NDA) and radiologically contaminated areas is being reviewed.

(2) Military-Civil Coordination.

(a) A policy review is being conducted to resolve classification restrictions and facilitate closer accident response planning coordination between military and civil authorities.

(b) Criteria and guidance for planning with state and local authorities are being developed by DOD and FEMA.

(c) FEMA has initiated efforts to develop a procedures manual for the response of civil authorities.

(d) The Federal Radiological Monitoring and Assessment Plan (outlining the Federal responsibilities) is in coordination.

(e) Washington communications links are being strengthened and secure voice capability is being extended to FEMA.

(3) Designation of Military Response Forces.

(a) The action to pre-designate Initial Response Forces is being coordinated for inclusion in the Nuclear Accident Response Capability List (NARCL) which is maintained by the DOE/DOD Joint Nuclear Accident Coordination Center.

(b) Designation and definition of Service Response Forces are being developed by the individual Services.

(4) Individual and Unit Training.

(a) A Washington area Senior Executive Nuclear Accident Course (SENAC) is being developed.

(b) The Flag Officers' Nuclear Accident Course (FONAC) is being revised.

(c) The Nuclear Weapons Accident Response Training Package for initial and Service response forces is undergoing test verification.

(d) Training programs for European accident response personnel are being refined.

(5) Long-Range Planning for Joint CPXs and FTXs.

(a) A long-range exercise planning schedule has been adopted by the military response community; JCS will direct CPXs and coordinate FTXs.

(b) A Program Management Plan for nuclear weapons accident response is being developed.

(c) Initial planning meetings have been held for the 1982 CPX and the 1983 FTX (NUWAX-83).

(6) Software and Hardware to Support Response Operations and Training.

(a) The draft NARP is being revised to reflect lessons learned in NUWAX-81.

(b) A complete System Description is being developed for nuclear accident response. The System Description will provide a full analysis of tasks, responsibilities and interfaces in a nuclear weapons accident response.

(c) Work has begun to develop and field an Atmospheric Release Advisory Capability (ARAC) at fixed DOD sites; ARAC is a computer program that can estimate the extent of radioactive contamination from a weapons accident.

(d) Candidate options for radioactive contaminant simulants are being examined.

Progress is being made as a result of the NUWAX series, but there are other major and equally significant actions to be addressed.

(a) Dedicated long-haul communications assets.

(b) Dedicated logistics equipment.

(c) Radiological clean-up guidance.

(d) Codification of overseas accident procedures.

(e) Assignment of responsibility for the costs of the immediate response and long-term clean-up, and determination of who is authorized to obligate federal funds during the operation.

(f) Consideration of using National Guard or Reserve Units as response elements.

These are typical examples of the issues that, together with the on-going actions, will require sustained executive emphasis for expeditious improvement of the National response capability.

SECTION B

LESSONS LEARNED

1. COMMAND AND CONTROL:

a. Topic. Notification of Response Forces

(1) Comment/Discussion: The notification of March Air Force Base to dispatch the Initial Response Force (IRF) was not effectively communicated within DOD channels. The initial voice notification was not delivered in proper format and follow-up record message traffic was not released. This initial confusion in the notification process may be attributed in part to the artificiality of prepositioning the IRF in Las Vegas, Nevada prior to the exercise. The March AFB IRF received first notification of the helicopter crash by the Joint Task Group California Department of Transportation dispatcher, following a request for assistance by the California Highway Patrol, approximately 70 minutes after the accident occurred. This specific NUWAX-81 incident highlights the necessity for conducting rapid, direct notification and dispatch of the IRF by the most expeditious means possible in order to establish prompt federal presence at the accident scene. It also reveals that initial notification to a defense activity may not always be through defense channels. DOD procedures must accommodate this possibility.

(2) Conclusion: Notification of an accident can be inserted into military channels from any level of local, state, or federal government prior to formal DOD notification. Further reporting up the military chain-of-command by the DOD activity initially notified may be the first indication to higher levels that an accident occurred, and could provide a necessary backup should a formal notification procedure fail. The possibility of errors in notification is magnified by command post layering, and timely deployment of the IRF may be hindered by a notification process through intermediate levels of command. Consideration whould be given to having NMCC notify the IRF parent command directly by telephone with record traffic follow up through Service command channels.

(3) Recommendation: Service, DOE, FEMA and Office of the Joint Chiefs of Staff (OJCS) should insure that installation commanders, facility managers and state officials develop disaster plans that include notification to one another as soon as they are cognizant of a major accident. Within DOD, the National Military Command Center (NMCC) should select the Service/DOE identified Initial Response Forces, and with Service/DOE concurrence, immediately notify the IRF by telephone in order to minimize delays in notification and response time. This should be followed by record communications via the Service operations center. The recommended NMCC notification procedure would be effective upon Service/agency approval of a proposed change to the Nuclear Accident Capability Listing (NARCL) identifying Service/agency initial response forces.

b. Topic: National Military Command Center (NMCC)/Federal Emergency Management (FEMA) Notification Procedures.

(1) Comment/Discussion: Notification of DOE Headquarters and the State was not timely. At the time of NUWAX-81, the National Military Command Center (NMCC) "Fast Reaction Procedures Card (FRPC)" for Broken Arrow notification procedures did not include DOE Headquarters as an agency to be notified in the event of a nuclear weapon accident. The second round of notification, which included DOE Headquarters, took approximately twenty-seven minutes to complete. The DOE has the requirement to provide technical support to the nuclear weapon accident response community that is vital for effective recovery operations. FEMA is included on the FRPC, however, the California Office of Emergency Services was not notified by FEMA until 78 minutes after commencement of the exercise. The presence of state response forces on-scene in the early stages of the accident is important to ensure local civilian problems are addressed.

(2) Conclusion: Prompt Broken Arrow notification to DOE Headquarters is essential to ensure timely response by non-DOD response elements. Excluding the DOE from the FRPC notification procedures may delay the commencement of essential DOE

activities. FEMA notification to the state must be immediate to facilitate timely response by local civil officials.

(3) Recommendation: The DOD and FEMA should review nuclear weapon accident notification procedures -- FEMA with a view towards expediting notification to state and local officials, and DOD with a view towards rapid notification to key agencies.

c. Topic: Director of Military Support (DOMS) Relationship.

(1) Comment/Discussion: The relationship between nuclear weapon accident response elements and the Disaster Control Officer (DCO) needs amplification. The Army Operations Center (AOC) asked the on-scene commander's staff on at least two occasions why requests for support were not forwarded to the DCO rather than the AOC. The Director of Military Support (DOMS) is responsible for the monitoring and employment of DOD resources in connection with federal disaster relief assistance operations and performs this function through the DCO. The DCO, along with his staff disaster control element (DCE), responds at the request of FEMA and is responsible for exercising operational control over military forces/resources committed in support of FEMA. With the employment of the DCO/DCE, DOD forces at the scene are tasked with two separate missions under two separate chains of command; the on-scene commander's responsibility for DOD recovery activities and the DCO's responsibility to provide support not to DOD response forces but to FEMA efforts.

(2) Conclusion: The relationship of the Disaster Control Element to other military forces, and FEMA is not widely understood and should be clarified.

(3) Recommendation: Managerial personnel and their staffs need to be educated in the role and responsibilities of the Disaster Control Officer/Disaster Control Element. The Nuclear Weapons Accident Response Procedures (NARP) manual, Service directives, and Interservice Nuclear Weapon School curricula should all address distinct functions of the DOD accident response forces and the DCO. A procedure must be provided for transferring responsibilities should a federal disaster be declared.

d. Topic: Interagency/Service Coordination On-Scene.

(1) Comment/Discussion: Interagency/Service response forces eventually established a close working relationship on-scene. During the first two days of the exercise, the separate response elements displayed a tendency to operate independently as they accomplished their site recovery tasks. Only after the formal executive sessions were initiated on the third day of the exercise did the coordination process become fully effective. Excellent cooperation and coordination then took place by the team members, but proper and effective liaison within functional areas did not follow suit in all cases. As an example, adequate integration of team members did not occur in the radiological safety/health physics functional area.

(2) Conclusion: For effective coordination of Service/agency response elements to occur, element leaders must caucus at the first opportunity to ascertain each others' responsibilities, capabilities, assets and response roles. A formal organizational structure should be established as soon as possible. This will establish an environment that should prompt full cooperation and team work in each functional area. Service/agency response force managers will need to ensure that team effort is established in each functional area and at all levels. A centralized display of functional area progress in the command post will facilitate functional area coordination.

(3) Recommendation: The NARP and Service/agency documents must stress the importance of establishing executive meetings by response element leaders upon their arrival. Each response force must be prepared to provide the on-scene commander, on arrival, a formal listing of the response forces' capabilities. The NARP must stress the necessity for establishing a team relationship in each functional area as well as in the command post. A functional leader must be designated for each area. In addition, the NARP must stress the need to maintain an updated list of all assets available on-scene within each functional area.

e. Topic: National Level Command and Control.

(1) Comment/Discussion: FEMA, DOD and Service documents are not sufficiently specific on command and control responsibility in a joint response to a nuclear weapon accident. Most Service documents stipulate that command and control responsibility rests with the Service having custody of the weapon(s) at the time the accident occurs. For NUWAX-81, command and control remained with the National Military Command Center until the Assistant to the Secretary of Defense (ATSD(AE)), Director of Operations, OJCS, and the Director, Army Operations Center (AOC) decided that conditions warranted transfer of operation control from the National Military Command Center to the AOC. The DOD, DOE, FEMA Joint Agreement of January 1981 states, "The National Military Command Center will be responsible for initial National level command and control and response of DOD resources and personnel until conditions have stabilized, at which time command and control will be transferred to the responsible Service operations center." This National Military Command Center responsibility has been incorporated into the 10 March 1981 DOD Instruction 5100.52, but not in Service directives.

(2) Conclusion: DOD and Service directives are not in complete agreement on nuclear weapon accident response command and control responsibilities. FEMA directives do not adequately address command and control relationships between FEMA and other agencies. Failure to maintain consistency among various agencies can have a severe adverse effect on nuclear weapon accident response.

(3) Recommendation: The ATSD(AE), in coordination with the Services and OJCS, should direct and coordinate a review of all Defense Department documents relating to command and control of nuclear weapon accidents response forces to insure that command and control responsibilities are clearly defined and are in accordance with national level policy and guidance. ATSD(AE), DOE and FEMA should also take appropriate action to insure consistency among the directors of these three agencies. A formal, periodic review procedure should be established and maintained.

f. Topic: Communications Security. (DNA originated)

(1) Comment/Discussion: Lack of secure telephone links between NMCC and DOE and FEMA command centers caused some initial conference calls to be conducted over unsecure lines. This led to inadvertant disclosure of classified information concerning the accident.

(2) Conclusion: Command centers that will participate in a nuclear weapons accident situation should be provided with secure voice communications capabilities. Under crisis situations the need to communicate rapidly leads to instances in which classified information may be compromised.

(3) Recommendation: Provide secure voice links between NMCC and DOE and FEMA command centers.

2. RADIOLOGICAL SAFETY/HEALTH PHYSICS:

a. Topic: Instrumentation

(1) Comment/Discussion: California Department of Transportation responded with a beta gamma instrument and had no capability for detection of plutonium. The Initial Response Force (IRF) alpha monitoring instrumentation was incapable of measuring plutonium when the alpha radiation was masked by water or soil overburdens (simulated). It was also difficult to use in rough terrain without damage to the probe face. Fortunately, the Atmospheric Release Advisory Capability (ARAC) and Aerial Measurement System (AMS) capabilities were activated early in the exercise and provided information that might otherwise not have been available in a timely manner.

(2) Conclusion: Instrumentation that can determine the extent of contamination regardless of weather conditions or terrain should be available to those response elements first on the scene of an accident. Utilizing ARAC and AMS capabilities (well known within the DOD as a result of NUWAX-79 lessons learned, the NARP and Interservice Nuclear Weapon School (INWS) curricula) for defining the contamination pattern should not be a substitute for detailed ground surveys. The

ARAC and AMS products are the best means for defining the broad scope of the contamination problem but do not replace the requirement for conducting accurate pinpoint plotting that can only be done with hand-held radiac instruments.

(3) Recommendation: Service efforts should be increased to provide all-weather, all-terrain , state of the art instruments to IRF and SRF response forces

b. Topic: Radiological Control

(1) Comment/Discussion: No comprehensive health physics program was established. Not all resources available were properly employed. Some elements, such as the USAF Occupational and Environmental Health Laboratory (OEHL), were not effectively used. Air sampling data were not readily available for use by persons assessing potential airborne hazards, and soil analyses were virtually nonexistent. The California Office of Emergency Services" air sampling and soil analyses efforts outside the National Defense Area were not a coordinated extension of on-site monitoring. Concern about the lack of coordination among radiological safety and control elements was voiced at various ad-hoc meetings of representatives from these elements starting at D+1; however, actions taken during the exercise did not resolve these concerns. An in-depth review of personal protective equipment, contamination control station procedures, or of operations to be performed within the radiological control area was not conducted by health physicists. The coordination between DOD/DOE explosive ordnance personnel and DOE industrial hygienists during the weapon foaming operation was a good example of the coordination required at all times among all response force elements.

(2) Conclusion: Effective coordination among radiological safety and control elements was not achieved. Service and agency elements worked independently of each other, often with duplication of effort. There was poor use of available health physics resources. All available radiological data were not used as a basis directing further efforts.

(3) Recommendation: The NARP should stress the necessity for establishing a centralized radiological health center for consolidation, analysis, storage, documentation and dissemination of radiological data. The center's advisory staff should be comprised of representatives from the many radiological health and safety elements. Decisions, such as the appropriate personnel protective measures, should be made using the data and expertise available in the center. The on-scene commander should designate a lead health physicist as soon as possible and charge this individual with the management of an integrated comprehensive program of radiological control and monitoring.

c. Topic: Radiation Measurement Units

(1) Comment/Discussion: Atmospheric Release Advisory Capability (ARAC) results, Aerial Measuring System (AMS) results, field measurements and laboratory analyses are all reported in different units, e.g., micrograms/sq meter; microroetgens/hour; counts per minute; etc. Also, various health physics elements did not apply the same conversion factors to raw data to obtain final results. This created confusion about the radiological situation and about what values were to be used for comparison to criteria for determining protective measures.

(2) Conclusion: There is a need for use of common units (and conversion factors) for reporting radiological data. These units should be tailored to the specific use for which the measurement was made (i.e., appropriate criteria or standard) and to the extent possible, involve a minimum of conversion.

(3) Recommendation: DOE should attempt to develop, in coordination with DOD, common units for reporting radiological measurements made at nuclear weapons accidents.

d. Topic: Atmospheric Release Advisory Capability (ARAC)

(1) Comment/Discussion: ARAC results were requested early in the exercise by the NMCC. These results were slow in arriving and were not in a form readily useable by senior government officials for decision making or public announcements.

(2) Conclusion: The ARAC capability provided by Lawrence Livermore National Laboratory as a service to DOE provides an extremely useful predictive decision tool that can be of great value to senior officials during the first few hours of an accident. However, the ARAC results must be provided in a timely manner and in a form readily understood by non-technical decision makers, otherwise the ARAC output is counter productive.

(3) Recommendation: DNA and DOE, as a priority task under a DNA sponsored ARAC improvement program, take steps to improve ARAC format and ensure rapid dissemination of ARAC data to the NMCC/FEMA and response force commanders.

3. COMMUNICATIONS:

a. Topic: Communications Mutual Support

(1) Comment/Discussion: Within one hour after arriving on-site, the Initial Response Force (IRF) had High Frequency (HF) and satellite voice communications using a mobile communications package. By midday of D+1, FEMA, DOE and the California Office of Emergency Services (CAOES) had sufficient land line and satellite communications in operation. The Service Response Force (SRF) Autovon Secure Voice Communication (AUTOSEVOCOM) was operational on D+1 but became inoperative on D+2. The SRF did not have fully operating record communications until D+5. Each agency that responded had equipment available to meet their particular needs; however, an effective sharing of all communications resources did not take place in a timely manner. Actions taken later, such as the sharing of tactical radios, considerably aided the overall recovery effort.

(2) Conclusion: The failure of the responding units to effect timely coordination among themselves upon arrival at the accident scene contributed to many of the communications problems that plagued the SRF.

(3) Recommendation: All response elements, upon arrival at an accident site, should immediately exchange information concerning their communications assets and a consolidated list of capabilities/assets should be included in the Communication Electronic Operating Instruction (CEOI).

b. Topic: Communications Equipment

(1) Comment/Discussion: The Service/agency response elements arrived on-site with a variety of communications equipment. The California Office of Emergency Services (CAOES), FEMA and DOE communication equipment served their needs. With the exception of secure voice, the Initial Response Force (IRF) mobile communications equipment was adequate. The Service Response Force equipment provided for the exercise was adequate for the NUWAX-81 scenario. However, real-world line problems resulted in a significant delay in establishing a reliable two-way record communications link. If Service-owned, JCS-controlled satellite equipment had been available to the SRF, dependence upon a poor, overtaxed rural telephone system would not have been necessary. AUTOVON access was only available through Nellis AFB and Kirtland AFB operators. This procedure precluded the use of the automatic-dial feature of the SRF telephone switchboard, seriously delaying both incoming and outgoing AUTOVON calls. FTS and commercial access instructions were not promulgated in the player telephone directory.

(2) Conclusion: State emergency response forces communications equipment will vary greatly among the fifty states. In many cases, the state may require communications support from the federal response elements placing an even greater demand on federal assets than experienced in NUWAX-81. The absence of secure communications at the onset of an accident is a deficiency. It is unlikely that a mobile secure communications capability is available at the IRF level. Secure communication is essential and feasible at the SRF level. Failure to deploy with a satellite voice and record communication capability severely hampered DOD response forces from communicating in an effective and responsive fashion.

(3) Recommendation: JCS/Service contingency plans should identify satellite communications packages for support of nuclear weapon accidents. Additionally, the equipment should be utilized for nuclear weapon accident

exercises in order to identify and experience problems that may occur under real conditions.

4. SECURITY:

a. Topic: National Defense Area (NDA)/National Security Area (NSA) Management

(1) Comment/Discussion: The Initial Response Force (IRF) on-scene commander established a large National Defense Area (NDA) in an attempt to include the likely area of contamination as well as weapons/weapons debris. This resulted in an initial NDA measuring approximately 1.4 miles long, .8 miles wide, and with a perimeter of approximately four miles. With a 20-man security element to manage the entry control point, provide guard relief, and man the perimeter, the IRF was unable to post sufficient guards to accomplish adequate perimeter security. The IRF on-scene commander was well aware of his manpower problem and requested security personnel augmentation from his home base and local law enforcement agencies on several occasions. The exercise artificiality prevented this request from being filled. This NUWAX-81 observation highlighted the manpower problem that all IRF security elements will likely face in responding to a nuclear weapon accident from a normal installation alert posture.

(2) Conclusion: The early posting of an NDA/NSA is essential to establishing proper federal security control. It is expected that the IRF on-scene commander will attempt to establish a large security area until greater knowledge is gained on location of weapons/weapons debris and contamination boundaries. Establishing proper security of an accident site is a complex undertaking requiring a large, properly trained and equipped force led by experienced personnel. The Initial Response Force security element is limited in its capability to implement a comprehensive security program under normal force structures. First consideration should be rapid deployment by the IRF to the accident site without unnecessary delay that may be imposed by formation of a large response element. Consequently, it is imperative that the IRF security element be augmented as soon as is practicable

by any available military personnel or civil law enforcement officers. Additionally, the on-scene commander must consider using personnel other than designated security personnel to provide entry control to known or suspected contaminated areas if adequate security of weapons cannot be accomplished using security personnel for for both tasks.

(3) Recommendation: An NDA(s)/NSA(s) should be established promptly to provide proper federal security control at the site. The NARP should highlight the necessity for the IRF to plan on augmenting the security element with additional installation/facility personnel and civil law enforcement officials on a high priority basis as the situation requires. The IRF should plan and be equipped to provide security personnel with anti-contamination protective clothing in the event the establishment of proper security requires their presence within the radiological control area. Additionally, the NARP should stress the need for the IRF to utilize experienced security personnel in supervisory positions.

5. MEDICAL:

a. Topic: Interagency/Service Coordination of Radiation Medical Problems

(1) Comment/Discussion: The most significant shortfall from a medical-casualty standpoint in the NUWAX-81 exercise occurred in early coordination of radiation health problems. This was most evident in the first two days of the exercise, the time the potential benefits for treatment to an exposed or potentially exposed populace is at its optimum. Although initial attempts to identify exposed personnel and offer guidance for decontamination was given, it was incomplete, and not followed through promptly on D+1 or D+2. This situation remained basically unchanged until the Radiological Advisory Medical Team from Walter Reed Army Medical Center arrived to provide the sustained physician input to locate, monitor and treat, if needed, any exposed civilians. Several starts were made by the initial response force, the California Radiological Health Agency and some effort from the on-scene commander's staff physician, but the real coordination did not occur until D+3.

(2) Conclusion: The major shortfall is the absence of a physician knowledgeable in radiation accidents who is charged with the responsibility of management and coordination of all efforts. Given the tremendous impact of a nuclear weapons accident on the population, the loss of the opportunity to quickly and efficiently minimize, as much as possible, the hazard to exposed personnel is one of the most serious defects that can occur in an accident.

(3) Recommendation: Both the Initial Response Force and Service Response Force should include a physician with special training and knowledge of health problems incurred in a radiation accident.

b. Topic: On-Scene Treatment of Contaminated Casualties

(1) Comment/Discussion: An individual working within the radiological control area suffered a compound fracture (simulated) which subsequently became contaminated. The patient, in shock (simulated), was delivered to the SRF's emergency medical team (EMT) stationed at the contamination control station. EMT personnel caused a delay in administering first aid by dressing out in anti-contamination clothing before treating the patient. The patient was then transported to the base camp hospital where a Radiological Advisory Medical Team (RAMT) representative arrived who offered sound advice concerning contamination containment and treatment. This advice was largely ignored as the base camp medical facility refused to accept the patient for treatment. The RAMT personnel were, therefore, forced to perform field expedient decontamination of the patient.

(2) Conclusion: In order to properly and expeditiously treat on-scene casualties, medical personnel should have training in the special handling required for field treatment of contaminated patients. Support personnel must be trained and prepared to accept and treat casualties occurring in the response forces.

(3) Recommendation: IRF and SRF and support forces should insure that medical team members receive proper training in field management and treatment of radiologically contaminated patients, especially in life and death situations.

Further, the guidance contained in the NARP concerning management of contaminated patients should be expanded and the role of the RAMT emphasized.

6. WEAPONS OPERATIONS:

Topic: Control of Weapons Recovery Operations

(1) Comment/Discussion: The Explosive Ordnance Disposal (EOD) teams and the DOE Accident Response Group (ARG) were very cooperative in weapons recovery operations from the beginning of the exercise. Adjacent working facilities in the command post area contributed significantly. EOD team hands-on expertise was complemented by the DOE ARG's knowledge of weapons details, diagnostic capabilities and communication with home laboratories for supporting calculations. However, planning of activities to be accomplished and debriefing of activities completed received insufficient attention. At times, direction and control of weapons recovery operations were lacking. Plans were made, but activities frequently deviated from the plans or actions were continued well beyond the point to which planning had been accomplished and procedures agreed upon.

(2) Conclusion: Effective weapons recovery efforts can be realized only through the integration of DOD and DOE capabilities. Direction and control of hands-on weapons activities is best accomplished by placing a single individual in charge of all weapons operations. A carefully thought out plan for weapons recovery will contribute significantly to safe and effective field operations.

(3) Recommendation: The NARP guidelines on the merging of the EOD and DOE ARG efforts should be expanded with emphasis on their respective responsibilities and capabilities. The need for formal joint planning such as ad hoc written procedures, dry runs and communications should be included. The senior DOD EOD officer should be in charge of weapons operations and should advise the on-scene commander.

7. PUBLIC AFFAIRS:

a. Topic: Confirmation of Presence of Nuclear Weapons

(1) Comment/Discussion: A draft revision of DOD Instruction 5230.16, Nuclear Accident and Incident Public Affairs Guidance, was implemented for NUWAX-81. Early confirmation of the presence of nuclear weapons was made by the National Military Command Center based on guidance provided in the draft instruction. When the Initial Response Force (IRF) arrived at the accident site, the Public Affairs Officer (PAO) was confronted with many news media personnel carrying wire service stories stating that the DOD had confirmed the presence of nuclear weapons. Having received no official information on the details of the NMCC release, the on-scene PAO would neither confirm nor deny the presence of nuclear weapons until contact was made with the NMCC, nearly two hours after he arrived at the scene. Although the lack of official knowledge on-scene of DOD's news release caused some conflict between information being released on-scene and in Washington, once confirmation was received by the IRF PAO, DOD credibility was regained. This specific element highlights the larger concern that the on-scene commander and Washington managers establish an early communication link for information exchange and that each be immediately informed of their respective public affairs developments.

(2) Conclusion: Early confirmation of the presence of nuclear weapons was consistent with the draft Public Affairs Guidance considering the accident scenario. Lack of coordination between the NMCC and the IRF resulted in some degree of confusion on-scene concerning press releases. The positive effect of eliminating the "confirm or deny" problem, however, considerably lessened the burden of media/PAO interplay. It is likely that public radio announcements in a real accident scenario would have alerted the IRF commander to the fact that a Washington announcement had been made. Exercise artificiality prevented this.

(3) Recommendation: The IRF PAO must be informed if the NMCC has confirmed the presence of nuclear weapons. This should be done prior to the arrival of the IRF, if at all possible, to preclude misunderstanding between the PAO and the news media at the scene. The draft revised DOD Instruction 5230.16 should be finalized and

published so that current PAO guidance is available to the DOD. The IRF PAO must monitor public radio to detect Washington announcements. Consideration should also be given to planning for the use of public media radio and TV to provide civil instructions.

b. Topic: Joint Information Center (JIC)

(1) Comment/Discussion: The JIC was not established until early on D+1, primarily because only the initial response force had a Public Affairs Officer (PAO) on-site until late on D-Day. No substantive information was passed to the news media on D+1 until the formal news conference was held in the afternoon. There was much confusion getting the JIC organized because no Service or agency was designated responsible for its operation. Much time was wasted while leadership roles were evolving. Control of JIC operation was not in accordance with DOD draft Instruction 5230.16. Defacto leadership eventually developed and news releases were jointly written and approved by the JIC members. News conferences were held more frequently, thus giving the media more timely information. FEMA representatives believed that FEMA should have had lead responsibility for the JIC since FEMA contends it is responsible for coordination of the overall federal response to the accident. The JIC was understaffed, had no reproduction equipment, no clerical support, inadequate communication and was constantly immersed in problems of the moment. This hampered attempts to establish an internal information program and a community relation program. The DOD Public Affairs Officer was also assigned as the Protocol Officer. This required him to be absent at different times and adversely affected the operation of the JIC.

(2) Conclusion: The concept of a Joint Information Center proved to be effective. News conferences should be held frequently during the first critical hours and days after the accident. Although defacto JIC leadership emerged, JIC operation would have been more effective had lead agency responsibilities been designated in advance. However, the JIC functioned in a cooperative manner without

agreement that a single agency was in charge. Sufficient public affairs and clerical personnel, equipment, and communications are needed for successful JIC operations. Protocol officer duties interfered with the DOD Public Affairs Officer's ability to perform his primary mission.

(3) Recommendation: During the first few days following an accident, news conferences should be held as frequently as practicable. The JIC must be provided with sufficient mission-dedicated personnel, equipment, and communication assets to efficiently perform its job. A lead agency for the JIC should be designated in the joint DOD, FEMA, and DOE agreement on nuclear weapon accident response. The NARP must be clear in discussing the probable magnitude of press activity in the event of an actual accident.

8. LOGISTICS:

Topic: Base Camp

(1) Comment/Discussion: The prepositioning and erection of the base camp was an exercise artificiality that recognized the logistics problem of assembling, transporting, and erecting such a support facility in a timely manner. Certainly, a more primitive facility would be acceptable in the early stages of an emergency; however, even with extensive preplanning, it required approximately five days to set up camp, not including travel time and horizontal construction time.

(2) Conclusion: In order to provide basic life support to nuclear accident response forces in a rural or remote area where local civilian or federal support facilities do not exist, a base camp sufficient to support several hundred personnel must be established within the first few days following the accident or site recovery operations will be severely impeded.

(3) Recommendation: Nuclear weapons accident logistics requirements should be reevaluated and logistics contingency plans should be developed to provide necessary support to response forces on the highest priority basis.

9. LEGAL:

a. Topic: Radiological Health Protective Measures (Radiation Exclusion Area)

(1) Comment/Discussion: The authority of DOD forces to exclude the public from a contaminated area for health and safety reasons is in question. The NUWAX-81 National Defense Area (NDA) initially entailed the entire contaminated area. However, when the classified items were removed to a packaging and staging area, the justification for the original NDA was lost, but the need to control access to the radiological control area remained. The use of state or contract security forces to control access in the contaminated area was beyond the scope of the NUWAX-81 scenario and funding limits. Headquarters, Department of Army guidance to the on-scene commander stated he did have the authority to control access for health and safety reasons based upon the Atomic Energy Act of 1954. Absent positive law, the Posse Comitatus Act would seem to preclude the use of federal military forces to exclude the public from a Radiation Exclusion Area.

(2) Conclusion: Civil authority may not be immediately at the scene of an accident or may not have the capability to control a contaminated area. In order to protect the populace, the DOD should have authority to control a contaminated are. No definitive legal opinion exists defining the authority of the military in this situation.

(3) Recommendation: The office of the General Counsel, Departments of Energy and Defense, and Federal Emergency Management Agency should address the authority of the military to provide access control for a Radiation Exclusion Area.

b. Topic: Staff Support

(1) Comment/Discussion: The Initial Response Force (IRF) judge advocate (JA) staff consisted of a field grade officer and company grade officer. The Service Response Force (SRF) staff was composed of two company grade officers. No other response element brought an attorney to the accident site. As a result, when coordinating with the federal and state agencies on-site, the military lawyers had to deal with personnel with no legal background. The SRF lawyers' legal experience

left them poorly equipped to provide the on-scene commander with the best possible advice on the broad range of legal issues surrounding the scenario accident for NUWAX-81.

(2) Conclusion: The JA staffs at times were handicapped by having no legal representatives on-site from the involved federal and state agencies. More experienced JAs might have been better able to assist the on-scene commander in making timely decisions involving questions of law.

(3) Recommendation: FEMA, DOE, and state response teams should consider including a legal advisor. Further, SRF judge advocates should be the most knowledgeable that can be made available to the on-scene commander.

c. Topic: National Defense Area (NDA)/National Security Area (NSA)

(1) Comment/Discussion: DOD, DOE, and FEMA have accepted the NDA/NSA concept and included both the NDA and NSA in the Joint DOD/DOE/FEMA Agreement for Response to Nuclear Weapon Accidents and Significant Incidents Involving Nuclear Weapons. However, the establishment of a National Defense Area (NDA) and/or National Security Area (NSA) upon private land, thereby denying access of landowners to their property, is a situation which may be challenged by any number of parties. While the artificialities of NUWAX-81 did not allow full play of such actions, it is a certainty that the NDA/NSA will be a continuing issue of controversy. Moreover, no definitive legal opinion exists analyzing the basis for the NDA or NSA.

(3) Conclusion: The counsel on the scene has neither the time nor resources to prepare a full defense of the NDA/NSA.

(3) Recommendation: DOD and DOE general counsels should conduct research and prepare legal arguments that would be readily available if the legality of the NDA/NSA is challenged.

10. SITE RESTORATION:

a. Topic: Clean Up Guidance

(1) Comment/Discussion: In developing the recovery plan, the Environmental Protection Agency's proposed standards for transuranics in soil was accepted as the

clean up criteria. To reach this level, the top 6 inches of soil were to be removed resulting in a total of 1,127,000 cu. ft. of soil to be removed. Agreement on the standard was easily reached in the exercise environment; however, players were aware that the actual burden of clean up would not be required. Faced with such a task, political concerns or other factors not encountered in exercise play could make agreement on a clean up standard very difficult.

(2) Conclusion: Site restoration is a monumental problem that is significantly affected by the standards set for clean up. Guidance should be established and published to facilitate planning, and to avoid arbitration of such a standard in the event of an accident.

(3) Recommendation: The DOD, DOE, and Environmental Protection Agency, should continue efforts to establish federal radiological guidance for clean up.

b. Topic: Clean Up Management. (DNA originated)

(1) Comment/Discussion. The purpose of NUWAX-81 was met by the preparation of a site restoration plan by the on-scene commander in conjunction with FEMA, state and DOE on-scene officials. Under actual accident conditions the approval of this plan by responsible local, state, and federal officials would have been a protracted process entailing technical review, allocation of costs and considerable public interest. It is likely that public hearings, new public law and extensive legal actions would be a part of the clean up decision and execution process. The original Service Response Force may not be the best qualified team to plan, gain approval of and execute the recovery phase of an actual accident.

(2) Conclusion. Federal and state agencies must be prepared to replace or augment the SRF with long-term expert help. Consideration should be given to replacing the SRF on-scene commander with one trained in the disciplines appropriate to the clean up operation.

(3) Recommendation. Should a nuclear weapon accident occur, a recovery action team should be formed independent of the SRF. This team should prepare the

recovery plan and be prepared to relieve the SRF when conditions at the accident site have been stabilized and the weapons recovered.

11. TRAINING:

a. Topic: Training for Nuclear Weapon Accident Response Personnel

(1) Comment/Discussion: Personnel responding to a nuclear weapon accident require specialized training to familiarize them with the many unfamiliar aspect of the response effort. Many staff personnel do not recognize or immediately understand and relate to the various command and control relationships, acronyms, and terms, unique organizations, types of equipment, etc., which are used in support operations. Although formal training courses are provided by the Interservice Nuclear Weapons School to on-scene commanders and their staff, there is no formal training for Washington area officials or for FEMA regional officials.

(2) Conclusion: Formal nuclear weapon accident response training is necessary for all DOD, DOE, and FEMA response personnel, including both on-scene response personnel and Washington area personnel.

(3) Recommendation: The Secretaries of Defense and Energy and the Director, FEMA should develop nuclear weapon accident training to supplement that now available at the Interservice Nuclear Weapons School. Training should be provided on a periodic basis to all Washington area personnel, FEMA regional personnel and state personnel.

SECTION C

NUCLEAR WEAPONS ACCIDENT EXERCISE-81

RECOVERY OPERATIONS FLOW NETWORK

1. The Recovery Operations Flow Network was designed to display expected response force activities and events to be accomplished by functional area in order to reach the desired objectives of the exercise. Appendix 1 is the pre-exercise flow network that was used by the Joint Task Group Operations and Evaluation Division in predicting and monitoring player progress during the conduct of the exercise. Appendix 2 is the flow network display of events and activities as they actually occurred in exercise play.

2. The NUWAX-81 plan was patterned after the Nuclear Weapons Accident Response Recovery Operations Flow Network included in the Nuclear Weapons Accident Response Procedures (NARP) manual but was tailored specifically around the exercise scenario. The network plans depict the sequence, interdependencies, and interrelationships of elements in the major functional areas associated with accident response. The following is a discussion of the elements used in the design of the networks.

a. Activity. An activity is an element of the exercise represented on the network by a solid line. Anything that takes time to develop is an activity. For emphasis, some activities involving significant decisions are highlighted as a triangle in the plan.

b. Events. Events are points in time which indicate the beginning or the completion of one or more activities. Events are represented on the network by small rectangles. Significant events or major milestones in an activity are presented as large rectangles titled with descriptive information about the event. An activity cannot be started until its preceding event has been accomplished. Events succeeding an activity cannot be considered to have occurred until all activities flowing into that event have been accomplished.

c. Constraint. The interdependency or constraints between events, activities, and milestones are shown as arrowed dashed lines. These relationships are of a

specialized type which constrain the occurrence of a successor event until its associated predecessor event has occurred. Lines of constraint are associated with time only through their relationship with events.

3. The pre-exercise network was developed as a summary plan to aid in management of exercise operations. In constructing this network, FCDNA planners attempted to integrate operational flow in the following functional areas:

a. Command, Control and Communications

b. Weapons Recovery Operations

c. Radiation Control

d. Security

e. Communications

f. Logistics/Other Activities

g. FEMA/State Activities

A time scale was established for initial activities and events. However, since NUWAX-81 compressed activities which would normally require several months into 6 days of exercise play, precise time estimation was not considered essential for the network following the first twenty-four hours.

4. The amount of detail included in the pre-exercise network was largely based on assumptions developed early in the planning phase of the exercise. During the execution phase of the exercise, it became necessary to expand the scope of activity in some functional areas. In other areas, the scope was reduced.

5. The Recovery Operations Flow Network for NUWAX-81 proved to be a useful tool in the management of the exercise. The actual occurrence flow network (Appendix 2) developed during the execution phase, will provide a model to improve the design of the recovery network included in the NARP.

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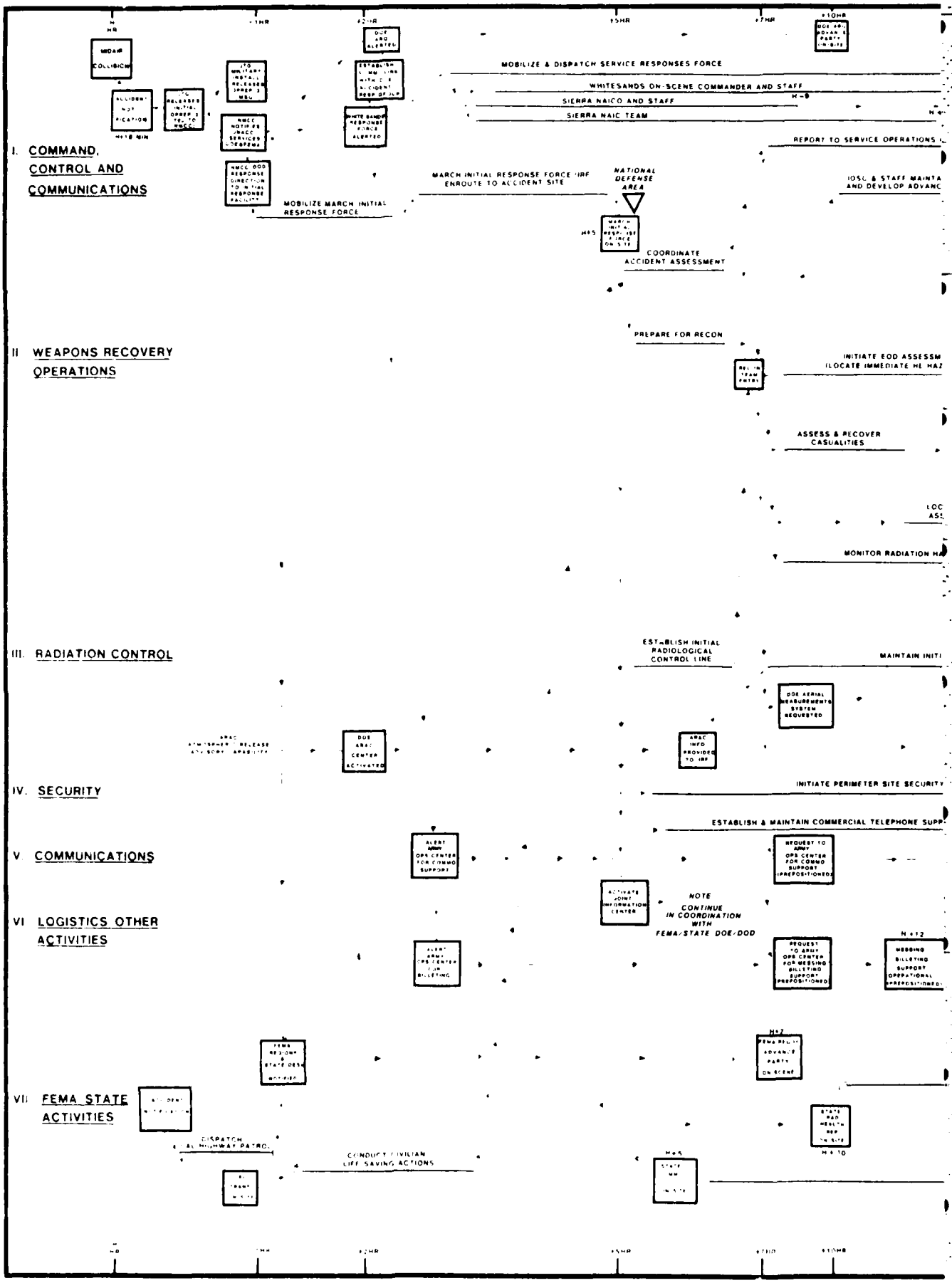

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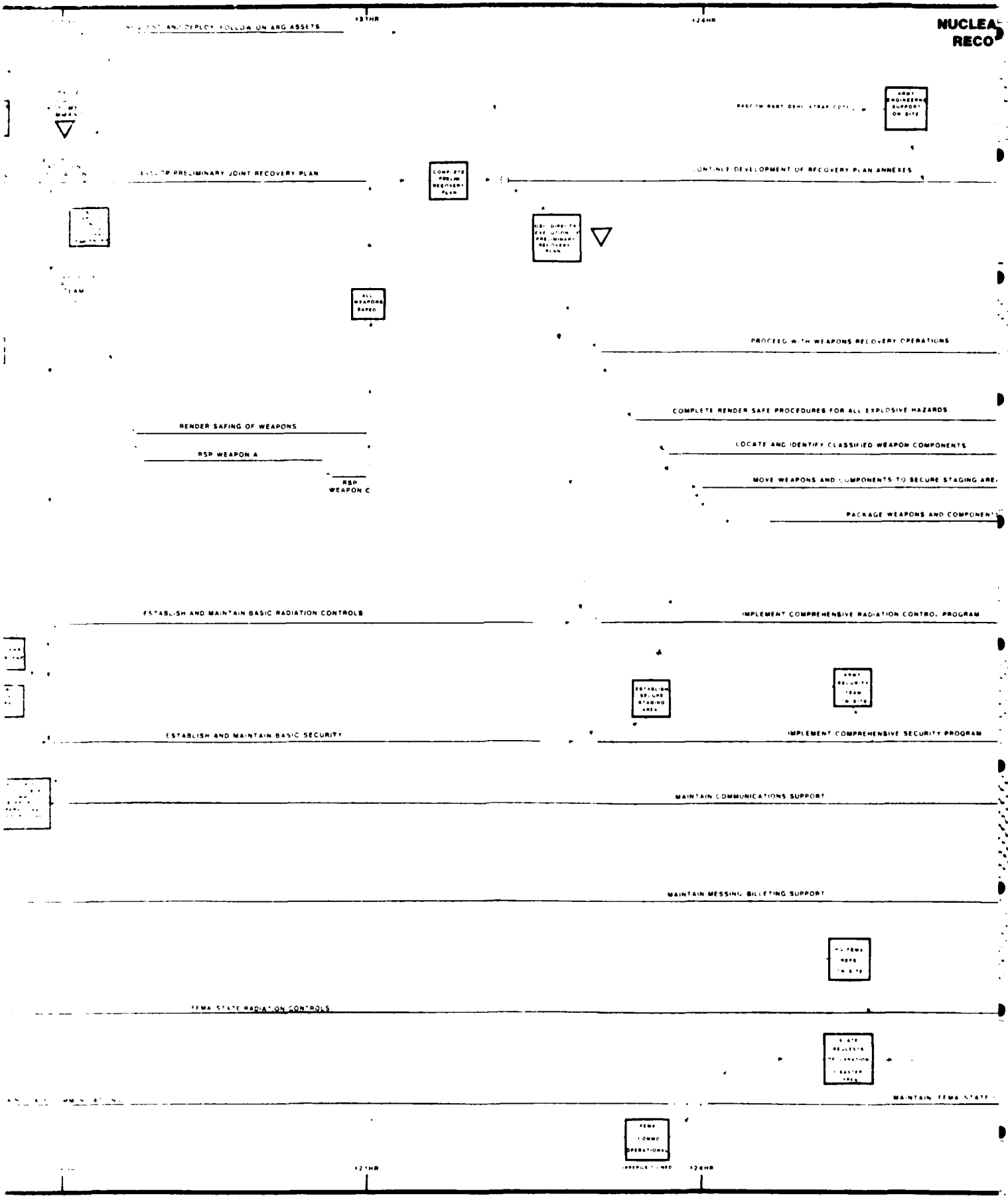

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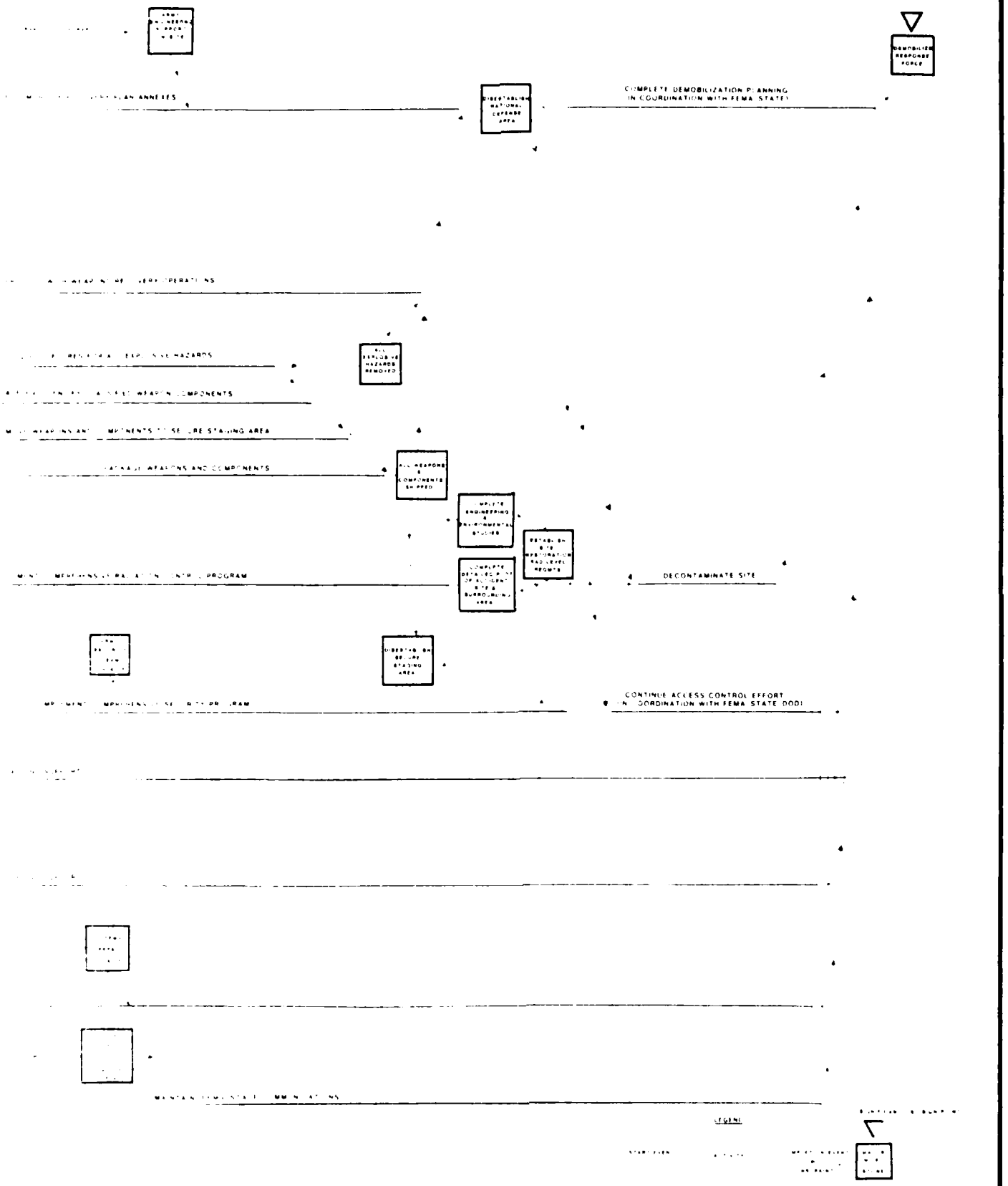

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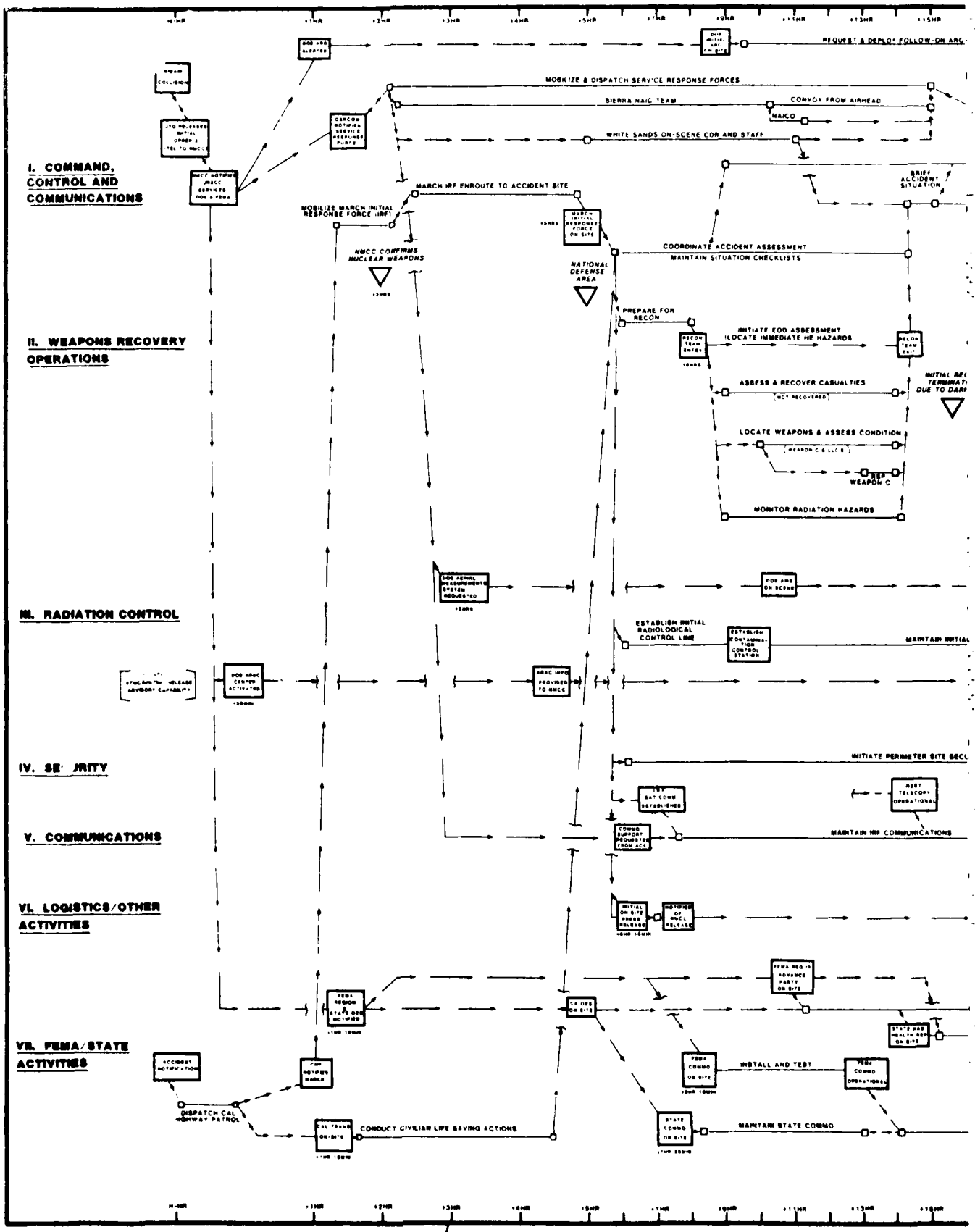

APPENDIX 2

D-day

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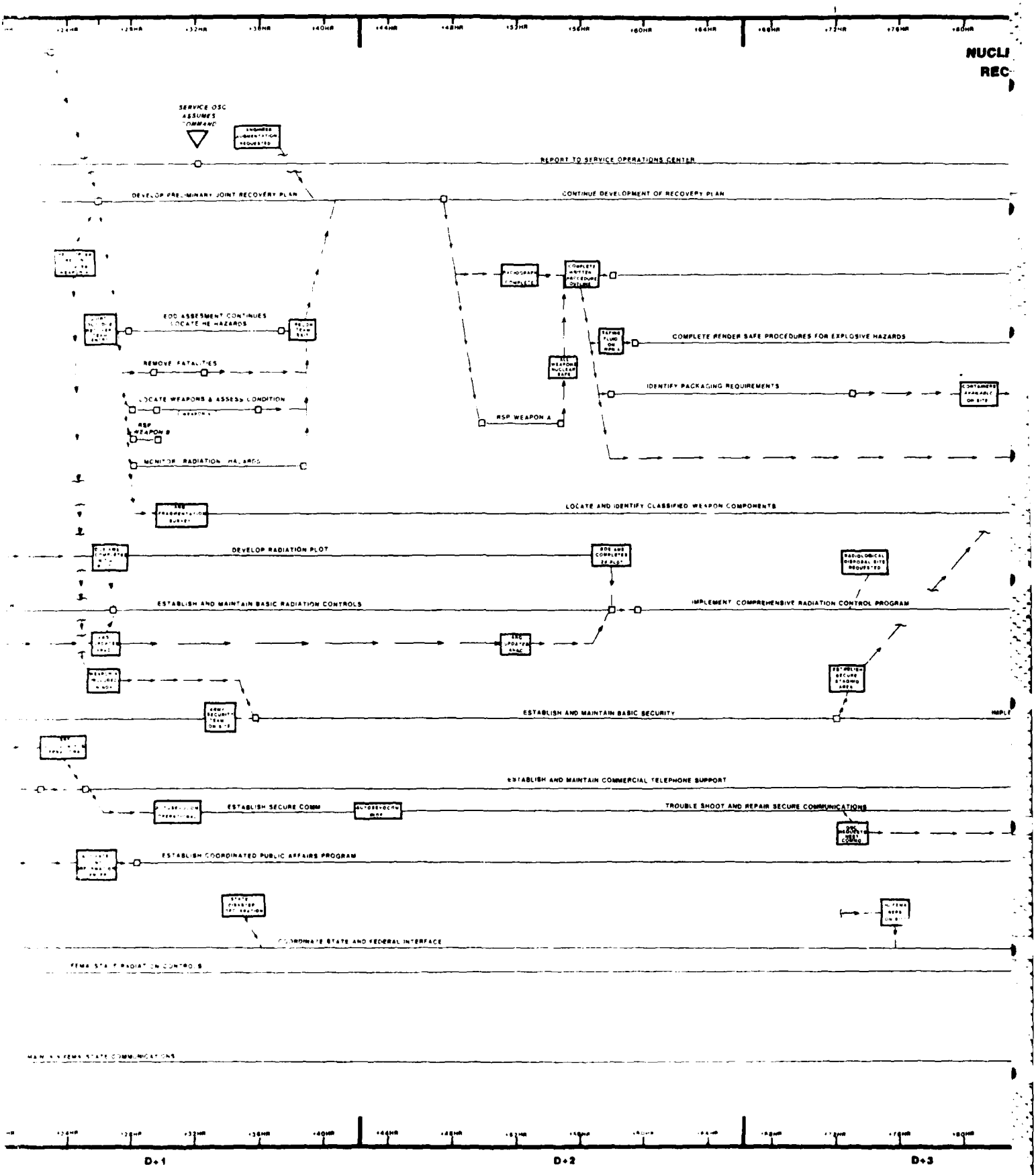

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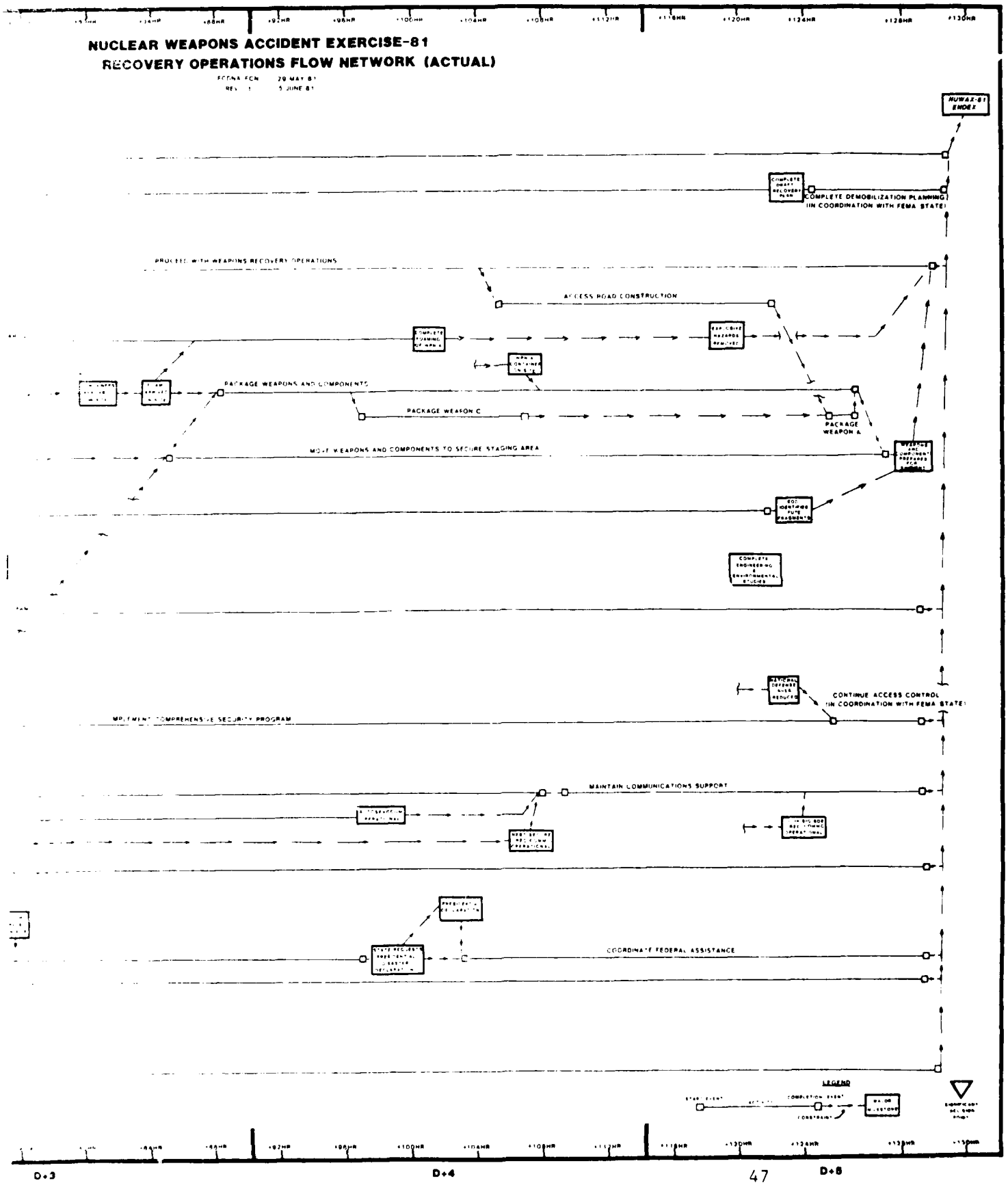

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SECTION D
ABBREVIATIONS

AF	Air Force
AMS	Aerial Measurement System
AOC	Army Operations Center
ARAC	Atmospheric Release Advisory Capability
ARG	Accident Response Group
ATSD(AE)	Assistant to the Secretary of Defense (Atomic Energy)
AUTOSEVOCOM	Autovon Secure Voice Communication
CAOES	California Office of Emergency Services
CCS	Contamination Control Station
CEOI	Communication Electronic Operational Instruction
CP	Command Post
CPX	Command Post Exercise
DCE	Disaster Control Element
DCO	Disaster Control Officer
DOD	Department of Defense
DOE	Department of Energy
DOE/AL	(DOE) Albuquerque Operations
DOE/NV	(DOE) Nevada Operations
DOMS	Director of Military Support
DRF	Disaster Response Force
ECS	Exercise Control Staff
EOC	Emergency Operation Center
EOD	Explosive Ordnance Disposal
EMT	Emergency Medical Team
FCDNA	Field Command, Defense Nuclear Agency
FEMA	Federal Emergency Management Agency

FONAC	Flag Officers' Nuclear Weapons Accident Course
FRMAP	Federal Radiological Monitoring and Assessment Plan
FTX	Field Training Exercise
FY	Fiscal Year
HF	High Frequency
HQDNA	Headquarters, Defense Nuclear Agency
INWS	Interservice Nuclear Weapons School
IRAP	Interagency Radiological Assistance Plan
IRF	Initial Response Force
JA	Judge Advocate
JCS	Joint Chiefs of Staff
JIC	Joint Information Center
JNACC	Joint Nuclear Accident Coordinating Center
NARCL	Nuclear Accident Response Capabilities Listing
NARP	Nuclear Weapons Accident Response Procedures Manual
NCAIC	Nuclear Chemical Accident/Incident Control
NDA	National Defense Area
NMCC	National Military Command Center
NSA	National Security Area
NTS	Nevada Test Site
NUWAX	Nuclear Weapons Accident Exercise
OEHL	Occupational and Environmental Health Laboratory
OJCS	Office of the Joint Chiefs of Staff
OSC	On-Scene Commander
PAO	Public Affairs Officer
RADCON	Radiological Control Team
RAMT	Radiological Advisory Medical Team
SENAC	Senior Executive Nuclear Accident Course

SONAC	Senior Officers' Nuclear Accident Course
SRF	Service Response Force

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Interservice Nuclear Weapons School ATTN: NOTB Kirtland AFB, NM 87115	10
HQ AFCS ATTN: DOOXD Scott AFB, IL 62225	1
HQ AFCS ATTN: DON Scott AFB, IL 62225	1
Headquarters Alaskan Air Command ATTN: DOOH Elmendorf AFB, AK 99506	1
HQ ESC ATTN: DOSA San Antonio, TX 78243	1
HQ AAVS ATTN: DOPW Norton AFB, CA 92409	1
HQ ADCOM ATTN: DOXSD Peterson AFB, CO 80914	1

U.S. Air Force (cont)

22 NORAD Region/OND CFB North Bay Hornell Heights Ontario, Canada POH1PO	1
HQ Tactical Air Command ATTN: DOXBE Langley AFB, VA 23665	1
HQ, 9th Air Force ATTN: DOSS Shaw AFB, SC 29152	1
HQ, 12th Air Force ATTN: DOOS Bergstrom AFB, TX 78743	1
HQ USAF Academy ATTN: XOXD Colorado Springs, CO 80840	1
HQ USAFE ATTN: DOH APO NY 09012	5
HQ AFSC ATTN: TEOX Andrews AFB, DC 20334	1
HQ AFSC ATTN: SGPA Andrews AFB, DC 20334	1
6570 ABG ATTN: DOH Brooks AFB, TX 78235	1
AMD ATTN: RDR Brooks AFB, TX 78235	1
USAF OEHL ATTN: CC Brooks AFB, TX 78235	1
HQ Strategic Air Command ATTN: DOTU Offutt AFB, NE 68113	2
HQ Strategic Air Command ATTN: LGWN Offutt AFB, NE 68113	1

U.S. Air Force (cont.)

HQ Strategic Air Command ATTN: SGPB Offutt AFB, NE 68113	1
HQ Strategic Air Command ATTN: OIP Offutt AFB, NE 68113	1
HQ 8th Air Force ATTN: DOTTD Barksdale AFB, LA 71110	1
HQ 15th Air Force ATTN: DOTFD March AFB, CA 92518	1
HQ AFRES ATTN: DOH Robins AFB, GA 31098	1
4 AF(R) ATTN: DW McClellan AFB, CA 95652	1
10 AF(R) ATTN: DW Bergstrom AFB, TX 78743	1
14 AF(R) ATTN: DW Dobbins AFB, GA 30060	1
MACOS ATTN: XOZS Scott AFB, IL 62225	4
22 AF ATTN: DOXS Travis AFB, CA 94535	2
21 AF ATTN: DOXS McGuire AFB, NJ 08641	2
22 Combat Support Group ATTN: CD March AFB, CA 92518	3
PACAF ATTN: DOH Hickam AFB, HI 96853	1

U.S. Air Force (cont.)

HQ 13 AF 1
ATTN: DOH
APO San Francisco 96274

HQ 5 AF 1
ATTN: DOH
APO San Francisco 96328

HQ 314 AD 1
ATTN: DOH
APO San Francisco 96570

U.S. Marine Corp

Commandant of the Marine Corps 3
Department of Defense
ATTN: LMW/50
Washington, DC 20380

Federal and State Agencies

Federal Emergency Management Agency 12
Plans and Preparedness PP-GP-TE
ATTN: Mr. Splain
Washington, DC 20472

Federal Emergency Management Agency 5
Region IX
211 Main St.
ATTN: Mr. Schroder
San Francisco, CA 94105

California Office of Emergency Services 10
P.O. Box 9577
ATTN: Mr. Watkins
Sacramento, CA 95826

Foreign Governments

GD3(RAF), Ministry of Defence (AIR) 1
Old War Office Bldg
Whitehall London
SW1A 2EU, UK

AWRE 1
Supt of Facilities Safety
ATTN: Mr. W. Saxby
Aldermaston, Berhs. UK

Royal Naval College 1
Nuclear Dept
ATTN: Mr. C. Marchant
Greenwich UK

Foreign Governments (cont.)

DOTC 4-5 National Defence Headquarters Ottawa, Ontario K1A0K2, Canada	1
SRGD Department of Defence (Air Force Office) Russell Offices Canberra Act 2600, Australia	1
SO GD Air Staff Defence Headquarters Wellington, New Zealand	1

END

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