A STUDY TO DETERMINE THE FEASIBILITY OF UTILIZING THE INCIDENT COMMAND SYSTEM AS ADOPTED BY THE NATIONAL FIRE ACADEMY FOR THE COMMAND AND CONTROL OF RESOURCES AT EMERGENCY INCIDENTS AT REFINING AND PETROCHEMICAL FACILITIES IN CORPUS CHRISTI, TEXAS.

STRATEGIC ANALYSIS OF FIRE DEPARTMENT OPERATIONS

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NATIONAL FIRE ACADEMY

Executive Fire Officer Program
1990
Outstanding Research Award

Presented by the Faculty to

Robert C. Andrews, Jr., P.E.

For your contribution to the professionalism of the Nations Fire Service through your Applied Research Project written for the course of

Strategic Analysis of Fire Department Operation

Wallace E. Stickney P.E.
Director,
Federal Emergency Management Agency

Administrator,
United States Fire Administration

S. W. Hill
Superintendent,
National Fire Academy

KNOWLEDGE

I. ABSTRACT

The Refinery Terminal Fire Company (RTFC) was formed in 1948 as a non-profit corporation to provide quality emergency response and training services to member owners of refineries, industrial or manufacturing plants, terminal tank storage and oil docks in the Corpus Christi Bay Area. Today, RTFC's membership has expanded to include the fifty-three (53) facilities of twenty (20) member corporations and the Port of Corpus Christi Authority.

The RTFC, due to its large multi-jurisdictional response area, has to operate an Incident Command System which is effective in seven major compliance areas. The RTFC subsequently proposed the adoption of the National Fire Academy's Incident Command System (NFA ICS) as the regional ICS for the Corpus Christi Bay Area and agreed to evaluate the adoption of the NFA ICS in a RTFC pilot program.

The adoption of the NFA ICS by RTFC was evaluated through a series of meetings, interviews, and training sessions.

The cumulative results and findings of the evaluation process, which were the product of RTFC employee consensus, were:

1. The "Fire Command" system as utilized by the RTFC since January 1, 1986 has been extremely effective.

2. The existing RTFC "Fire Command" system should not be abandoned and replaced by the NFA ICS, but rather, the existing RTFC "Fire Command" system should be enhanced by incorporating certain components of the NFA ICS.

   The following specific enhancements resulted from the study:

(1.) "Operations", "Planning", "Logistics", and "Finance" should be incorporated as functional areas.

(2.) "Safety", "Liaison", and "Information" should be incorporated as formal staff functions.

(3.) No significant benefit to adopting the NFA ICS terminology of "Division", "Group", and "Branch" was perceived. Further, the training effort which would be required to institute the change, exceeded any potential benefit.

(4.) The change from "Command" to "I. C." was perceived to be counterproductive.

The resulting employee recommendations to improve the existing "Fire Command" system was validated through two emergency simulations and one major refinery fire.

Recommendations, subsequently, related to the administrative and operational action necessary to formalize the implementation of the "Revised Fire Command" system.

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III. INTRODUCTION

The Refinery Terminal Fire Company (RTFC) was formed in 1948, one year after the famous Texas City, Texas ship explosion, as a non-profit corporation to provide quality emergency response and training services to member owners of refineries, industrial or manufacturing plants, terminal tank storage and oil docks in the Corpus Christi Bay Area.

Today, RTFC's membership has expanded to include the fifty - three (53) facilities of twenty (20) member corporations and the Port of Corpus Christi Authority (Table 1).

Of these fifty - three individual facilities (Table 2), virtually all have adopted a facility "Emergency Plan" incorporating myriad corporate, regulatory and local governmental requirements. Six of our corporate member facilities also operate an internal Emergency Response Team (ERT) (Table 3).

In the 6 facilities with ERTs, the role of RTFC is to blend into the existing in-plant organization with equipment, staff and technical expertise and assume an appropriately active command role to assist the member company facility, always maintaining safety overview for RTFC personnel. In some facilities the transfer of Incident Command to the first arriving RTFC Command Officer is preferred by the facility management, in other cases an integrated command post is operated. In the 37 facilities which are not protected by a facility Emergecy Response Team, RTFC operates its command system as standard practice.

TABLE 1. REFINERY TERMINAL FIRE COMPANY - MEMBER COMPANIES -

AMERADA HESS CORPORATION

AMERICAN CHROME & CHEMICALS, INC.

CHAMPLIN REFINING AND CHEMICALS, INC.

CHEMICAL WASTE MANAGEMENT, INC.

COASTAL REFINING & MARKETING, INC.

DIAMOND SHAMROCK

E. I. DUPONT DE NEMOURS & COMPANY

EXXON PIPELINE COMPANY

HOECHST CELANESE
ENGINEERING PLASTICS DIVISION
CORPUS CHRISTI TANK STORAGE

KOCH REFINING COMPANY

MOBIL PIPE LINE COMPANY

OXY PETROCHEMICALS, INC.
PETROCHEMICALS DIVISION
CORPUS CHRISTI PLANT

THE PERMIAN CORPORATION

PORT OF CORPUS CHRISTI AUTHORITY
(POCCA)

SOUTHWESTERN REFINING CO., INC.
(SWOR)

SUN MARINE TERMINALS, INC.

TEXAS FUEL & ASPHALT CO., INC.

TIPPERARY CORPORATION

TRIFINERY

VALERO HYDROCARBON COMPANY
CORPUS CHRISTI FRACTIONATION PLANT
SHOUP PLANT

VALERO REFINING COMPANY

TABLE 2. REFINERY TERMINAL FIRE COMPANY - FACILITIES PROTECTED - POLITICAL JURISDICTION -

FACILITY	POLITICAL JURISDICTION	FACILITY PROTECTED BY ERT
AMERADA HESS CORPORATION	INDUSTRIAL DISTRICT	NO
AMERICAN CHROME & CHEMICALS, INC.	INDUSTRIAL DISTRICT	NO
HOECHST CELANESE		
(A) 2-60,000 BBL TANKS OFF W. BROADWAY	CITY OF CORPUS CHRISTI	NO
(B) 50,000 BBL SPHERE OFF E. NAVIGATION	INDUSTRIAL DISTRICT	NO
CHAMPLIN REFINING & CHEMICALS, INC.		
MAIN PLANT	INDUSTRIAL DISTRICT	YES
WEST PLANT	INDUSTRIAL DISTRICT	NO
DEEP SEA TERMINAL	INDUSTRIAL DISTRICT	NO
OIL DOCKS #3 & #6	INDUSTRIAL DISTRICT	NO
TANK FARM 90	INDUSTRIAL DISTRICT	NO
TANK FARM 91	INDUSTRIAL DISTRICT	NO
CHEMICAL WASTE MANAGEMENT, INC.	NUECES COUNTY	NO
COASTAL REFINING & MARKETING, INC.		
COASTAL MAIN	INDUSTRIAL DISTRICT	YES
COASTAL WEST	INDUSTRIAL DISTRICT	YES
COASTAL QUINTANA	INDUSTRIAL DISTRICT	YES
COASTAL - BELCHER OIL CO.	CITY OF CORPUS CHRISTI	NO
DIAMOND SHAMROCK	INDUSTRIAL DISTRICT	NO
E. I. DUPONT DE NEMOURS & COMPANY	SAN PATRICIO COUNTY	NO
EXXON PIPELINE COMPANY		
VIOLA TERMINAL	INDUSTRIAL DISTRICT	NO
INGLESIDE TERMINAL	SAN PATRICIO COUNTY/ CITY OF INGLESIDE	NO
KOCH REFINING COMPANY		
KOCH MAIN	INDUSTRIAL DISTRICT	YES
KOCH WEST	INDUSTRIAL DISTRICT	YES
TERMINAL #2 - TRIBBLE LANE	INDUSTRIAL DISTRICT	NO
MOBIL PIPE LINE COMPANY	CITY OF CORPUS CHRISTI	NO
OXY PETROCHEMICALS, INC.		
CORPUS CHRISTI	INDUSTRIAL DISTRICT	YES
DOCK FACILITY	INDUSTRIAL DISTRICT	YES
PORT OF CORPUS CHRISTI AUTHORITY		
OIL DOCKS 3, 4, 7, 11	INDUSTRIAL DISTRICT	NO
OIL DOCKS 8, 9, 10	INDUSTRIAL DISTRICT	NO
OIL DOCKS 1, 2	INDUSTRIAL DISTRICT	NO
OIL DOCK 12	CITY OF CORPUS CHRISTI	NO
OIL DOCK 6	INDUSTRIAL DISTRICT	NO
CARGO DOCK 1, 2, 3, 4, 5, 6	CITY OF CORPUS CHRISTI	NO

TABLE 2. CONTINUED

FACILITY	POLITICAL JURISDICTION	FACILITY PROTECTED BY ERT
CARGO DOCK 8	CITY OF CORPUS CHRISTI	NO
CARGO DOCK 15	CITY OF CORPUS CHRISTI	NO
RICHARD KING TERMINAL	CITY OF CORPUS CHRISTI	NO
CARGO DOCK 9, 10	INDUSTRIAL DISTRICT	NO
CARGO DOCK 12	INDUSTRIAL DISTRICT	NO
PUBLIC GRAIN ELEVATOR	INDUSTRIAL DISTRICT	NO
BULK MATERIAL DOCK	INDUSTRIAL DISTRICT	NO
PERMIAN CORPORATION	CITY OF CORPUS CHRIST/ INDUSTRIAL DISTRICT	NO
SUN MARINE TERMINALS	INDUSTRIAL DISTRICT	NO
SOUTHWESTERN REFINING CO., INC.		
MAIN PLANT	CITY OF CORPUS CHRISTI/ INDUSTRIAL DISTRICT	YES
TERMINAL #3 & MOBIL ANNEX	CITY OF CORPUS CHRISTI	YES
TERMINAL #1	CITY OF CORPUS CHRISTI	YES
OIL DOCKS	CITY OF CORPUS CHRISTI	YES
LAND FARM	NUECES COUNTY	NO
COMMAND POST- EBONY STREET	INDUSTRIAL DISTRICT	YES
OFFICE BUILDING	CITY OF CORPUS CHRISTI	YES
TEXAS FUEL & ASPHALT	INDUSTRIAL DISTRICT	NO
TIPPERARY CORPORATION	SAN PATRICIO COUNTY	NO
TRIFINERY	INDUSTRIAL DISTRICT	NO
VALERO REFINING COMPANY	INDUSTRIAL DISTRICT	NO
VALERO HYDROCARBON		
CC FRACTIONATION PLANT	INDUSTRIAL DISTRICT	YES
SHOUP PLANT	NUECES COUNTY	YES

TABLE 3. RTFC MEMBER COMPANIES OPERATING ON-SITE EMERGENCY RESPONSE TEAMS (ERTs)

CHAMPLIN REFINING & CHEMICALS, INC.

COASTAL REFINING & MARKETING, INC.

KOCH REFINING COMPANY

OXY PETROCHEMICALS, INC.

SOUTHWESTERN REFINING COMPANY

VALERO REFINING COMPANY

During 1989 our industrial members were monitoring the development of the Occupational Safety and Health Administration's 29 CFR Part 1910 "Hazardous Waste Operations and Emergency Response".

This legislation, which on March 6, 1989 became an interim final rule, had significant impact to Industry as it required that "The senior emergency response official responding to an emergency shall become the individual in charge of a site-specific Incident Command System (ICS)".[1] Also included were specific responsibilities for the individual in charge of the ICS. At the time the author attended the Strategic Analysis of Fire Department Operations (SAFEDO) course at the National Fire Academy in November of 1989, two member refineries had not only developed their own Incident Command System, but had also completed training and implementation.[2, 3] The ICS development by the other major refining and petrochemical facilities in the Corpus Christi Bay Area at this time was also prolific.

In the public sector, the Corpus Christi Fire Department had adopted the "Fire Command"[4] system as its departmental Incident Command System and had just completed initial in-service training of all its companies.

The Refinery Terminal Fire Company had the longest established Incident Command System, having instituted the "Fire Command" system in January of 1986. The RTFC had also developed a draft "Corpus Christi Ship Channel Refining/Petro-Chemical Incident Command System." This system addressed two critical organizational challenges present at emergencies at large industrial facilities; the inherent geographical division between in-plant and off-site resources; and the need to incorporate the management staff of the industrial

facility at both the strategic and tactical level. By September of 1989, three large RTFC member facilities had agreed to participate in a pilot program to evaluate the proposed system.

During the two week SAFEDO program at the National Fire Academy, it became quite apparent through the process of lecture, case study and simulation that not only is the use of an Incident Command System necessary to effectively manage large emergency events, the use of a common Incident Command System by all responding organizations is also required to maximize safety and efficiency and minimize incorrect action due to misunderstanding and differences in terminology.

Subsequently, the "Petro - Chemical ICS" pilot program was placed on "hold" and this applied research project was initiated to identify an Incident Command System which could be adopted by all of the firefighting agencies (public, military or private sector, career or volunteer), in the Corpus Christi Bay Area. In order to meet the project goal, the research process was divided into two phases as follows:

Phase 1

A study was performed which included the larger firefighting organizations in the Corpus Christi Bay Area interested in, or impacted by, the regional adoption of a common Incident Command System to determine their level of interest and obtain suggestions for the research, testing and implementation process.

Phase 2

This phase included the adoption or development of the actual regional Incident Command System, the development of a pilot program to test the proposed system, and the presentation of the final product for approval. Due to the somewhat fragmented and duplicative approach to ICS development within the Corpus Christi Bay Area, and in order to expedite the research process, the author proposed the regional adoption of the National Fire Academy's Incident Command System (NFA ICS) for four (4) reasons:

1. The Federal Emergency Management Agency (FEMA) embraced the Integrated Emergency Management System (IEMS) concept as its new approach to comprehensive emergency management at all levels of government in 1983.[5] Further, the National Fire Academy cites ". . . it becomes clear that existing fire service programs such as the Incident Command System (ICS) are part of the broader concept of IEMS. The ICS-IEMS identifies the need for "baseline" fireground command systems to provide for a predictable, coordinated, effective and acceptable response to emergencies of all types by the fire services of this country."[6] Subsequently, it was also theorized that the local adoption of the NFA ICS, due to its relationship with IEMS, would facilitate the integration of state and federal agencies should an emergency of sufficient magnitude occur locally.

2. It was speculated that due to the federal support of IEMS, that law enforcement, emergency medical services, emergency management, and public works agencies at the local and state level would also eventually adopt IEMS, either wholly or in part. It was believed that the adoption of IEMS by these agencies together with the local fire service, would provide a common command structure which would yield more cooperative and effective emergency coordination, as a result of common understanding and terminology.

3. The local adoption of the NFA ICS could reduce the cost of curriculum development associated with a localized Incident Command System, as the NFA curriculum is in the public domain and to a large degree is available through the National Audio Visual Center.

4. The NFA ICS, having not been adopted by any fire service agency in the Region, could be viewed as a neutral proposal as no single agency had a vested interest in its adoption.

Having once selected the National Fire Academy Incident Command System for use in the research project, it was also recognized from a practical standpoint, that in order to actually be adopted, the NFA ICS would have to meet two (2) crucial criteria:

1. The adoption of the NFA ICS would have to yield sufficient benefits to organizations currently operating under a different command system.

2. The implementation and utilization of the NFA ICS at refining and petrochemical facilities would have to be both feasible and practical.

The execution of phase 1 of the research project yielded the following results:

1. There was consistent agreement that the adoption of a common ICS system would be beneficial.

2. The Corpus Christi Fire Department advised that they would adopt the Incident Command System agreed upon by the Refinery Terminal Fire Company and the Ship Channel / Industries.

3. The three large RTFC member companies who agreed to participate in the prior "Petro-Chemical ICS" Pilot Program advised that they would endorse a recommendation by RTFC for the adoption of a specific ICS, if RTFC made a conscientious effort to accommodate their existing facility Incident Command Systems into the proposed regional system.

At this juncture it became quite obvious that due to time constraints, and the organizational dynamics of this regional issue, that the scope of phase 2 of this research project would need to be limited strictly to the adoption of the NFA ICS by the Refinery Terminal Fire Company.

IV. BACKGROUND AND SIGNIFICANCE

The Refinery Terminal Fire Company recognized the need for an incident command system in January of 1986 and adopted the "Fire Command" system at that time.

Since 1986, the use of an incident command system has also been formally recognized by entities outside of RTFC, the result being the need for RTFC to coordinate, cooperate or comply with these outside organizations with priority usually dependent upon the jurisdictional influence of the individual entity. Subsequently, the RTFC is constantly evaluating the capabilities of its Incident Command System to maximize its effectiveness in the following seven (7) areas:

1. Compliance with the Federal Law 29 CFR 1910.120 "Hazardous Waste Operations and Emergency Response; Final Rule"

2. Compliance with the consensus standard "NFPA 1500 - Standard on Fire Department Occupational Safety and Health Program - 1987 Edition"

3. Compliance with "Annex Q - Hazardous Materials Response" as adopted by Nueces County and the City of Corpus Christi, Texas which addresses at the community level, the requirements of the federal law "Superfund Amendments and Reauthorization Act of 1986", and specifically its "Title III - Emergency Planning and Community Right-To-Know"

4. Compliance with the "Marine Safety Zone Corpus Christi Port Fire Plan" as promulgated by the Commanding Officer, U.S. Coast Guard, Marine Safety Office, Corpus Christi, Texas.

5. Coordination with any Incident Command Systems in use at a RTFC member company facility (Table 2).

6. Coordination with any Incident Command System in use by a public fire department with mutual jurisdiction at an RTFC member company facility (Table 2).

7. Coordination with the participants of the "Reciprocal Aid Agreement with other Mutual Aid Organizations along the Texas Gulf Coast" those participants, in addition to RTFC, are:

Channel Industries Mutual Aid	Houston
Texas City Industrial Mutual Aid System	Houston
Sabine - Neches Chiefs Association	Beaumont
Mutual Aid Mont Belview	Mont Belview

From an organizational perspective, any effort such as this research project, to standardize Incident Command Systems used by RTFC and those organizations also affected in the seven (7) aforementioned areas, is a justified expenditure of resources. The administrative, training, documentation and operational benefits to having a common regional Incident Command System should be intuitively obvious.

This applied research project directly relates to the Executive Fire Officer course in that the model Incident Command System used in the curriculum was presented through the study for actual adoption by the author's organization.

While there has been significant literature published about Incident Command Systems and specifically the implementation of those systems by the municipal fire service, there still remains a literary abyss with regard to the detailed application of Incident Command Systems to emergency operations at major industrial and manufacturing facilities. In fact, the absence of literature which

contained specific information about the intricacies of command at refinery and petrochemical facilities prompted the author to publish a draft textbook[7] in 1984 after conducting an unsuccessful three year literature search. This literature search was conducted concurrent with the development of a comprehensive emergency plan for a chemical and engineering resins plant in South Texas where the author was employed.

Significant collaboration in 1989 between the author and R. Ian Stronach, Loss Prevention Manager for Alcan Aluminum Limited, Canada's largest employer, also yielded no specific text for industrial ICS. In fact, a seminar sponsored by Alcan in May of 1989 entitled the "Emergency Management and Command School" which was presented to Alcan fire chiefs from around the world, utilized Brunacini's Fire Command and the author's Emergency Scene Management as compendium texts.

The final search for literature which addressed the application of ICS to the petrochemical industry yielded in April of 1990, one extremely significant piece of work. Ron Taylor, the Chairman of Channel Industries Mutual Aid published a memorandum to their membership entitled "CIMA Incident Command System Proposal" This letter asked the CIMA membership to review the proposal in detail for potential adoption at their General Membership Meeting on February 28, 1990. The proposal, "Channel Industries Mutual Aid Incident Command System 2/90", directly related to the ICS development work at Refinery Terminal Fire Company as CIMA protects the Houston Ship Channel and its related industries, and while CIMA's internal structure is different from RTFC's, the Incident Command functions and complications are virtually duplicative.

Of interest, is the fact that both organizations (CIMA and RTFC) began their industry - related ICS development process at about the same time and with the same results. Details regarding a comparison of the CIMA ICS and the results of RTFC's study are contained under the "Recommendations" portion of this report.

Two meaningful emergency events occurred during the research project. The first event occured on October 23, 1989, when a major explosion ripped through the Phillps Petroluem Co. plastics plant in Pasadena, Texas, killing 23 workers and injuring 136. The second event occured on December 29, 1989, when a blast at Exxon's Baton Rouge Refinery killed two workers and injured seven others. While both events relate to the research project, due to resource constraints, research was limited to the Phillips fire.

As the Phillips explosion has been widely considered to be the largest post war industrial accident in the United States, significant effort was spent to follow the development of post accident activities.

The Phillips explosion was also notable due to the considerable amount of media attention it drew and the speed in which coverage of the disaster began. This research project attempted to incorporate, where possible, the prolific amount of material, both from a professional (firefighting, safety and emergency management) standpoint and from a regulatory standpoint which resulted after the Phillips explosion. One emergency management director wrote that "The explosion and fire at the Phillips plant in Pasadena, Texas, October 23, 1989, is one example of the need for a system that integrates multi -agency coordination in a comprehensive plan.[9] Due to both the magnitude of the disaster in terms of life and property loss, and the national media attention

it received, significant regulatory review and action was anticipated, the results of which became available in April of 1990.

Of interest during the research was whether or not it could be determined if the use of an Incident Command System was evaluated by regulatory agencies especially the U.S. Department of Labor, and whether a finding was made with regard to the effectiveness of the ICS. Elizabeth Dole, U.S. Secretary of Labor, published a report to President George Bush reviewing the Phillips explosion and fire.[10] The report provides the following account of the response to the accident.[11]

1. The Immediate Response

   The Phillips fire brigade provided the initial emergency response, which included administering first aid to injured employees and fighting the fire with onsite equipment. The effort was augmented by local emergency response units including fire, police, and ambulance and by the Channel Industries Mutual Aid organization (CIMA). CIMA, a cooperative of approximately 106 members in the Houston area, which included industrial facilities, municipal fire departments, the U.S. Coast Guard, the County Sheriff's Department, and the County Fire Marshal's Office, was established to provide assistance to its members in emergency situations. This assistance included trained firefighting, rescue, and first-aid personnel and equipment. Command of the site and coordination of the response were under the control of the Phillips Complex fire chief.

2. Firefighting

   The Phillips Complex did not have a dedicated water system for fighting fires. Water for that purpose came from the same water system that was used for the chemical process. Consequently, when the process water system was extensively compromised by the explosion, the plant's water supply for fighting fires was also disrupted. Fire hydrants were sheared off in the blast, and because of ruptures in the system, water pressure was inadequate for firefighting needs. It was necessary

to lay hose to remote water sources--settling ponds, a cooling tower, a water treatment plant, and a main at a neighboring plant. Of the three backup diesel pumps that could have been used to provide water pressure to fight the fire, one had been taken out of service and was therefore unavailable, and another soon ran out of fuel and it, too, went out of service. Electric cables supplying power to regular service fire pumps were damaged by the fire, and those pumps rendered inoperable. Nonetheless, the fire was brought under control within approximately 10 hours, with the help of several Phillips Complex fire trucks, which were able to pump foam on the fire, and with the assistance of firefighting equipment brought to the site by CIMA members and local fire departments.

3. Search and Rescue

   Search and rescue efforts could not begin until daylight when the fire and the tremendous heat generated during the fire had subsided. These efforts were difficult because of the danger of strustural collapse from the damage caused by the explosion. The U.S. Coast Guard and Houston fireboats evacuated more than 100 people from the facility and transported them across the Houston Ship Channel. These people had been in the Administration Building and would have had to cross the area of the explosion to reach safety had not the U.S. Coast Guard and fire department vessels been on the scene. The search was coordinated by the Harris County Medical Examiner and County Coroner. Any evidence that OSHA investigation personnel deemed useful in determining the cause of the accident was preserved during the search.

The report also includes the findings of OSHA's Investigation. Two specific statements directly relate to this applied research project.[12]

1. "The compliance team also evaluated the emergency response to the accident to determine the adequacy of Phillips emergency response plans."

2. "A major part of the emergency response was conducted by CIMA. Employees and equipment were supplied by the petrochemical companies along the Houston Ship Channel. OSHA evaluated CIMA's compliance with OSHA regulations in responding to the emergency, as well as the performance of two of the company members of the organization. Their

emergency response activities were performed in accordance with agency safety and health requirements."

The applicability of both the CIMA ICS system and the U.S. Department of Labor report to the subject research project will be addressed under "Discussion".

V. PROCEDURES

As stated in the introduction, the original goal of this applied research project was to identify an Incident Command System which could be adopted by all of the firefighting agencies in the Corpus Christi Bay Area.

Phase 1 of the research resulted in the Refinery Terminal Fire Company agreeing to develop a pilot program to analyze the feasibility of adopting the National Fire Academy Incident Command System. Phase 2 of this research project was limited strictly to the adoption of the NFA ICS by the Refinery Terminal Fire Company.

While the adoption of the NFA ICS was supported by the RTFC Fire Chief, it was also acknowledged that in order to be accepted by RTFC's work force and member companies, the NFA ICS would have to meet two (2) critical criteria.

1. The adoption of the NFA ICS would have to yield sufficient benefits to organizations currently operating under a different command system.

2. The implementation and utilization of the NFA ICS at refining and petrochemical facilities would have to be both feasible and practical.

As with any effort to make organizational change, presentation of the idea, solicitation of support, collection of feedback and design for implementation needed to take place. As resistance to change is human nature, the research process reflected a combination of education and salesmanship utilizing the following steps:

1. Meetings and individual interviews were conducted to propose the adoption of the NFA ICS and solicit opinion. Included in the study group were:

   a. RTFC senior staff.

   b. RTFC career and part-paid officers.

   c. RTFC member company incumbents responsible for existing facility ICS programs.

2. Input from RTFC fire officers and member company safety management obtained in step one was evaluated.

3. In a training environment, merits of adopting the NFA ICS were presented to the workforce. The NFA ICS was compared and contrasted with the "Fire Command" system currently in use.

4. Consensus recommendations were developed by the organization for the adoption of the NFA ICS.

VI. RESULTS:

As outlined in the procedures section of this report, the final thrust of this research project focused upon determining what the appropriate procedure would be for the Refinery Terminal Fire Company (RTFC) to use in adopting the National Fire Academy's Incident Command System (NFA ICS).

A concerted effort was made by the author to present the merits of adopting the NFA ICS at numerous meetings and during individual interviews of the RTFC senior staff, RTFC career and part-paid officers, and the RTFC member company incumbents responsible for the administration of the four facility Emergency Response Teams involved in phase 1 of the project study.

These efforts culminated at a RTFC regular training session for the part- paid staff on February 7, 1990. The subject of the training session was "Incident Command Systems" and the author was the lead instructor. The class included the following components:

1. A review of the "Fire Command" system as adopted by the Refinery Terminal Fire Company.

2. A presentation of the video tape "Fire Command in Action".[13]

3. A review of both the application and effectiveness of the "Fire Command" system at several significant emergency incidents during severe freezing conditions in December of 1989.

   Background: The merits of utilizing an "Operations" section at certain incidents had been previously discussed informally by senior staff. "Operations" was actually utilized at a working fire for the first time on December 22, 1989 and was utilized three additional times during the next three days.

Subsequently, the effectiveness of utilizing an "Operations" section was also critiqued.

4. A presentation by the author on the Incident Command System as adopted by the National Fire Academy.

   Background: This class was attended by the one career and two part-paid captains who completed the two-day Incident Command System Pilot Program at the National Fire Academy in Emmitsburg, Maryland, November 13, 1988. The attendance of these three National Fire Academy graduates greatly enhanced the quality of class discussion and the resulting class recommendations.

5. A discussion of deficiencies in the existing RTFC "Fire Command" system as identified by the class.

   Potential local emergency incident scenarios were identified and the "Fire Command" system and NFA Incident Command System were compared and contrasted with emphasis placed upon system complexity/simplicity, the capacity to organize very large, fast moving incidents, and the training demands related to both systems.

6. The administration of the "Departmental Evaluation" (Activity 1.1) as contained in the NFA Incident Command System pilot program.[14]

   The survey was administered confidentially in order to obtain candid student opinions.

7. A discussion of the survey results and an evaluation of the present level of effectiveness of the RTFC "Fire Command" system.

8. The identification, through the consensus process, of specific recommendations for improving the RTFC "Fire Command" system.

9. A determination of the acceptability, as perceived by the students, of the present level of written procedural documentation regarding the RTFC "Fire Command" system, identification of improvement areas and a timetable for implementation.

The class was extremely productive, discussion was frank and open, technical aspects were explored in depth and the importance of the subject was compared to other active organizational goals. The class discussion paralleled previous meetings.

The cumulative results and findings of phase 2 of this study were as follows:

a. The "Fire Command" system as utilized by the RTFC since January 1, 1986 has been extremely effective as evidenced at training exercises, emergency simulations and actual emergency events.

   Note: The class who participated in the "Departmental Evaluation" of the RTFC's "current emergency management system" rated the "Fire Command" system a 3.95 of a possible 5.0.

b. The existing RTFC "Fire Command" system should not be abandoned and replaced by the NFA ICS, but rather, the existing RTFC "Fire Command" system should be enhanced by incorporating certain components of the NFA ICS.

   The following specific enhancements resulted from the study:

   (1.) "Operations", "Planning", "Logistics", and "Finance" should be incorporated as functional areas.

   (2.) "Safety", "Liaison", and "Information" should be incorporated as formal staff functions.

   (3.) No significant benefit to adopting the NFA ICS terminology of "Division", "Group", and "Branch" was perceived. Further, the training effort which would be required to institute the change, exceeded any potential benefit.

   (4.) The change from "Command" to "I. C." was perceived to be counterproductive.

c. The organization believed that its current understanding of, and proficiency in, the RTFC "Fire Command" system was commendable.

Formal training classes, the use of the Fire Command text, workbook, and video tape, the consistent utilization of the "Fire Command" system at all training, non-emergency stand-by functions, and emergency activities, and a conscientious practice of critiquing operations has resulted in a very effective total learning experience for employees.

As RTFC's "Fire Command" system has been undergoing constant improvement since its inception, documentation of the "latest edition" has always lagged behind field implementation. This time lag has been acceptable previously due, for the most part, to RTFC relatively small size and corresponding organizational agility.

While the development of a written ICS standard operating procedure (SOP) may be required by regulatory and consensus standard organizations, the employees felt that the SOP would principally serve as formal documentation of a well established practice which has been in place for over four years. The development of the "Command SOP" had merit, although the prioritization of the work should not hinder the improvement of other areas in the organization which warrant resources and may not be in as good a practical condition as the "Fire Command" program.

VII. DISCUSSION

The administration of this applied research project was challenging as both the research process, and in fact the research premise itself, had direct impact on the employees of the Refinery Terminal Fire Company.

Further, a not so inconsequential aspect of the research was that the director of the research, who also happened to be "the boss", constructed the research so as the adoption of the NFA ICS was an expected conclusion.

The RTFC culture encourages employee suggestions and honest feedback on management proposals. Management respects that the employees are, in most cases, in the best position to judge whether changes affecting them will be an improvement or be counterproductive.

Using the "Departmental Evaluation" from the National Fire Academy's ICS course, RTFC employees were asked to grade the RTFC's current emergency management system using a rating scale of 0 to 5. A rating of 0 indicated that the RTFC emergency management system did not address the issues identified in the questions. A rating of 5 indicated that the evaluator was highly satisfied with how the RTFC emergency management system addressed the issues identified in the questions. The employees rated the current RTFC "Fire Command" system a 3.95. Discussion with the evaluation participants indicated that the overall score would have been higher, but questions regarding outside agency coordination received generally low marks due either to the lack of a common regional Incident Command System, or the fact that some area fire departments had still not implemented an ICS of any kind. In summary, the RTFC "Fire Command" system got very high marks, the

employees simply confirmed the need for a regional ICS through their own personal experiences and observations.

Also of significance was that this same evaluation was taken by four RTFC captains at the National Fire Academy in November of 1989 and at that time rated the current RTFC "Fire Command" system a 3.17. The increase in rating scores from 3.17 to 3.95 during the 14 month period reflects an improvement of 24.6%, confirming the regular organizational efforts in ICS development.

Essentially, the employees of RTFC, having spent considerable effort in gaining experience in the existing "Fire Command" system did not believe the adoption of the NFA ICS yielded sufficient benefit to the RTFC to justify a change in command systems. The strength of the employee sentiment was inherent in their ability to voice their recommendation in opposition to the Fire Chief's proposal.

Some research was held in abeyance while publications regarding the Phillips explosion become available. The importance of the Phillips explosion as it related to the research cannot be overstated, as it illustrated the true potential demand that a major emergency at a refining or petrochemical facility can place on an Incident Command System. Subsequently, it was understood that as a product of the research, the final proposed RTFC system would have to be applicable to a local event similar to Phillips. Several presentations regarding the Phillips explosion were made at the Industrial Fire World Exposition in Houston, Texas, April 17 - 19, 1990. It was at that seminar that CIMA's effort to develop their own ICS was first learned, and a copy of their written proposal of February, 1990 was obtained.

The similarities of the CIMA ICS (See Appendix) and the "Revised RTFC Fire Command" system, as proposed, are significant.

1. Both systems use the term "Command" for the Incident Commander.
2. Both systems incorporate the NFA ICS staff functions.
3. Both systems utilize a single designator below the functional level, RTFC utilized "Sector", CIMA utilized "Division".
4. While RTFC adopted the four functional sections of NFA ICS, CIMA adopted all but "Finance".

Since the OSHA investigation which was conducted post the Phillips explosion indicated that "(CIMA's) emergency response acitivities were performed in accordance with agency safety and health requirements", it is hoped that the "Revised RTFC Fire Command" system would also pass similar scrutiny.

Several revisions to the original research concept were necessary in order to take advantage of opportunities which developed due to the dynamic nature of this organizational study. Often it felt as though the research was attempting to keep up with a moving target. In fact, the opportunity to validate the employee's recommendations at a major fire was just plain luck, but provided authenticity which could not be omitted from the research.

Discussion with the four member company incumbents responsible for developing their internal Incident Command Systems, yielded an understanding of RTFC's individual ICS needs.

1. It was impractical for RTFC to operate differently at each Member Company as reflected by the facility's emergency plan and incident command system.
2. RTFC should continue to use its existing ICS, modify its existing ICS,

or develop a new ICS as it sees fit.

3. Member industrial facilities should understand that in order to utilize a common command system their own emergency plans and Incident Command Systems would most likely have to be modified and that sacrifice would be necessary for the overall improvement of RTFC and its 20 member companies.

The National Coordinating Council on Emergency Management (NCCEM) membership passed a resolution recently supporting the development of a "generic Incident Command System training and education program responsive to all disciplines of emergency management."[15]

Based upon the concern of the NCCEM, certainly the development of a generic ICS for the fire service has merit. In retrospect, it appears that both RTFC and CIMA have independently developed Incident Command Systems which have combined the attributes of both the NFA ICS (similar to the "California system") and the "Fire Command" system (similar to the NFPA or "Phoenix system").

Having reviewed this research, other fire professionals have suggested that the utilization of a generic ICS such as RTFC's or CIMA's would not be difficult for a proficient fire officer with experience exclusive to either system. In fact, most operatives can usually cope well when assigned to any fireground sector or division, as long as the designation is reasonably logical, with the difficulty of semantics usually relegated to academic dispute in the classroom.

If the generic Incident Command System proposed by NCCEM is to be accepted by the nation's fire service, a merger of the two predominant command systems in use nationally will probably be necessary. If this theory proves true, RTFC and CIMA will be positioned for this ICS of the future.

VIII. IMPLICATIONS

As addressed previously under "Discussion", this applied research project was not merely academic, but rather, was an actual organizational project for the Refinery Terminal Fire Company. Subsequently, the act of including the workforce in the review of the existing "Fire Command" system and developing recommendations for its improvement, implied that management would adopt the recommendations of the workforce.

Management endorsed the recommendations and directed their implementation at training sessions, drills, and emergency incidents whenever applicable. The recommendations were implemented and evaluated in a pilot program beginning February 9, 1990 and lasting until June 19, 1990. A summary of the pilot program and the resulting implications to the organization follow:

1. Mobil Pipe Line Drill - May 15, 1990

   This drill scenario included a fire in a large petroleum storage tank.

   Drill participants included personnel from Mobil Pipe Line, the Corpus Christi Fire Department, and Refinery Terminal Fire Company. While many tactical challenges were presented to the firefighting and pipe line operatives, the goals for "Command" were:

   a. Operate a unified command post as both responding fire departments had jurisdiction. RTFC had jurisdiction through its membership relationship with Mobil Pipe Line and CCFD had jurisdiction as the Mobil facility was within the Corpus Christi city limits.

b. Designate "Safety" as a staff function.

c. Designate "Operations" as a function due to the anticipated number of firefighting sectors and the geographical separation between the fire location within the facility and the main facility entrance point.

d. Operate a "unified" Operations. Assure that both an RTFC and a CCFD command officer are assigned to Operations, as RTFC and CCFD do not share the same radio frequency.

NOTE: RTFC had learned previously, that dividing fireground assignments by radio frequency (i.e. by agency), when possible, had proven much more effective than the mingling of different agencies to perform a common task or within a common sector. The segregation of agencies tended to yield the most effective and efficient radio communications, reduced confusion due to differences in equipment and procedures, and reduced potential conflict regarding chain-of-command.

All of the goals of the drill were achieved and the recommendations validated.

2. Southwestern Refining Company Fire - June 4, 1990

A significant fire occurred on June 4, 1990 which not only permitted, but actually required the implementation of the pilot program recommendations.

This fire stretched RTFC resources and command capability to the limit due not only to the fire's size, but also due to its complexity and duration. The resulting ICS organization used at the incident is shown in Table 4. "Information" was performed by the Refinery. Again, the recommendations were validated, especially the need for the "Planning", "Logistics" and "Finance" sections.

3. Valero Refining Company Drill - June 16, 1990

This drill sponsored by Valero Refining Company, involved the entire refinery organization, Val-Star (Valero's internal multi-mission response team), Refinery Terminal Fire Company,

Corpus Christi Fire Department (including its suppression units, Haz-Mat Team, High-Angle Rescue Team, and Emergency Medical Services Division) and the Nueces County Sheriff's Department.

Preparation for the drill spanned a two-month period and involved all of the agencies.

The drill scenario was as follows:

"Lightning strikes tank 150 - blows roof, fire debris lights off tank 107 - multiple injuries reported in Waste Water Treatment (5) - airborne debris strikes sulfuric acid system valve in Sulfur Recovery Unit, shears valve creating acid leak."

Drill planners agreed that two levels of evaluation would be performed, one at the command level and one at the sector level.

The goals of the command staff were:

a. Operate a unified command post including all participating agencies.

b. Due to the magnitude of the emergency, relocate the field command post, early in the incident, to a building to provide more appropriate command support.

c. Divide the incident into the following functional areas.

Operations - to direct the significant firefighting activity associated with the two petroleum storage tank fires.

Rescue - to direct the rescue of victims from elevated structures.

Medical - to direct the triage treatment, and transportation of the victims, including the utilization of a medical helicopter.

Haz-Mat - to direct the mitigation of the sulfuric acid leak.

Security - to direct all law enforcement, evacuation, traffic control, pedestrian control, and escort activities.

d. Designate "Planning" to provide command with an overview of all activity and the interrelationship of resources, field activity, and priority. Planning should perform a forecasting function, anticipating the potential growth of the emergency.

e. Provide for "unified" coordination at the functional level (Operations, Rescue, Medical, Haz-Mat, and Security) by providing a field command officer for each agency participating in that functional area.

Lessons learned from the drill were:

1. While agency chiefs documented their unit assignments well, the planning function for "Command" must be fully utilized to combine the documentation of the functional areas in one place.

2. While multiple radio frequencies are usually utilized at the functional area, a single radio frequency should be designated by command for the transmission of information between the functional management and the unified command post.

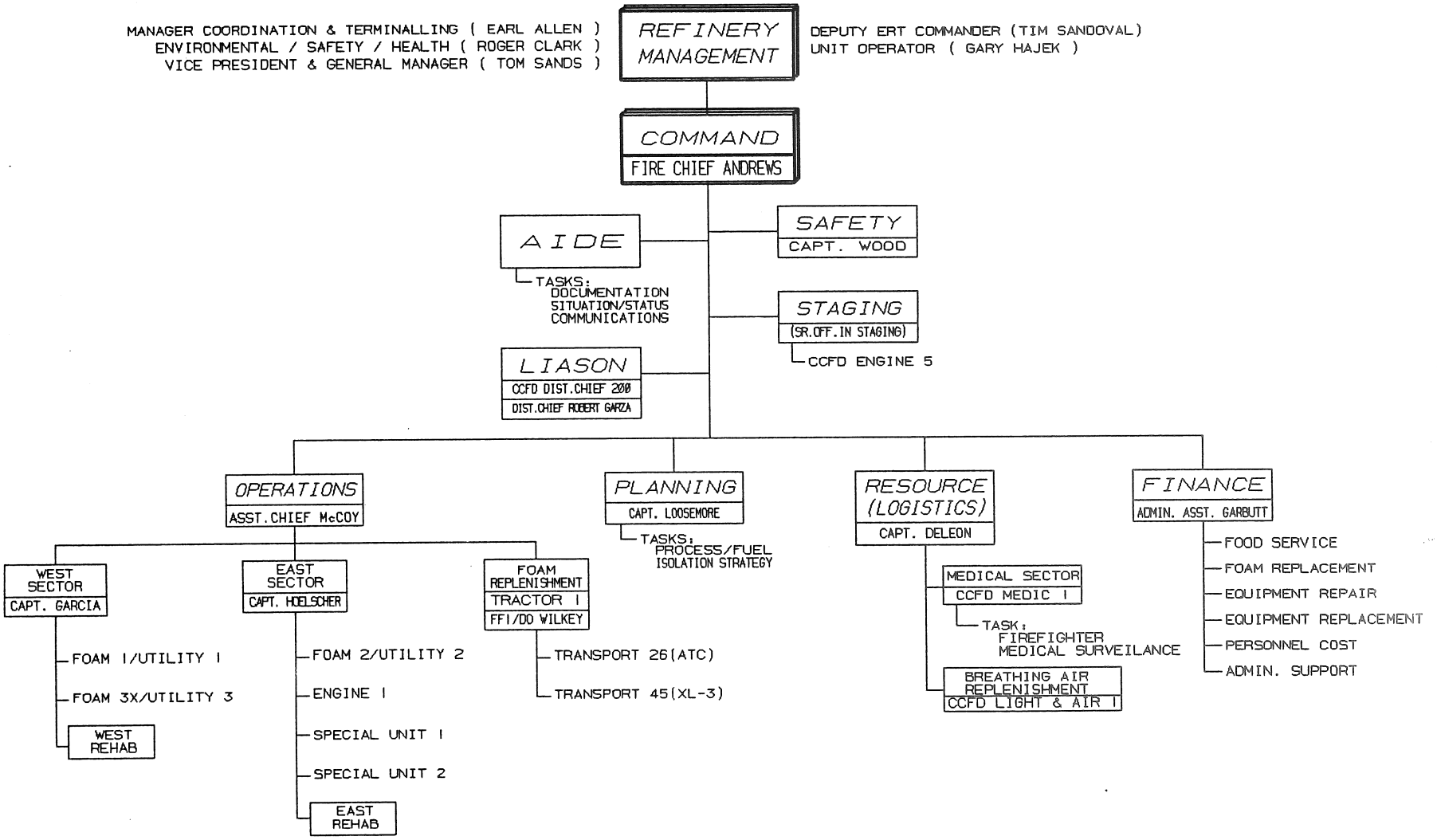
3. The designation of staging areas within the facility should utilize land marks rather than technical terms not familiar to offsite responders.

A drill of this magnitude had not been attempted since 1987, and while areas for improvement were identified, the participants unanimously regarded the drill as very successful.

Again, it was felt that the recommended changes to RTFC's "Fire Command" system were validated.

TABLE 4.

RESULTING ICS ORGANIZATION
FIRE IN BTX UNIT
SOUTHWESTERN REFINING COMPANY
MONDAY, JUNE 4, 1990, 0309 HRS-1038 HRS



IX. RECOMMENDATIONS

The testing and evaluation process described in the "Implications" section of this report provided ample justification for the complete adoption of the recommended enhancements to the RTFC "Fire Command" system as developed through employee consensus and outlined in the "Results" portion of this report.

The following recommendations relate to the administrative and operational action necessary to formalize the implementation of these changes.

1. Develop a written Standard Operating Procedure (SOP) outlining the "Revised Fire Command" system.

2. Develop the necessary forms (organizational chart, worksheet, etc.) to support personnel in the field application of the "Revised Fire Command" system. Use existing ICS forms used by Channel Industries Mutual Aid as a guide (See Appendix).

3. Provide for adequate incident scene staffing to properly implement and utilize the "Revised Fire Command" system.

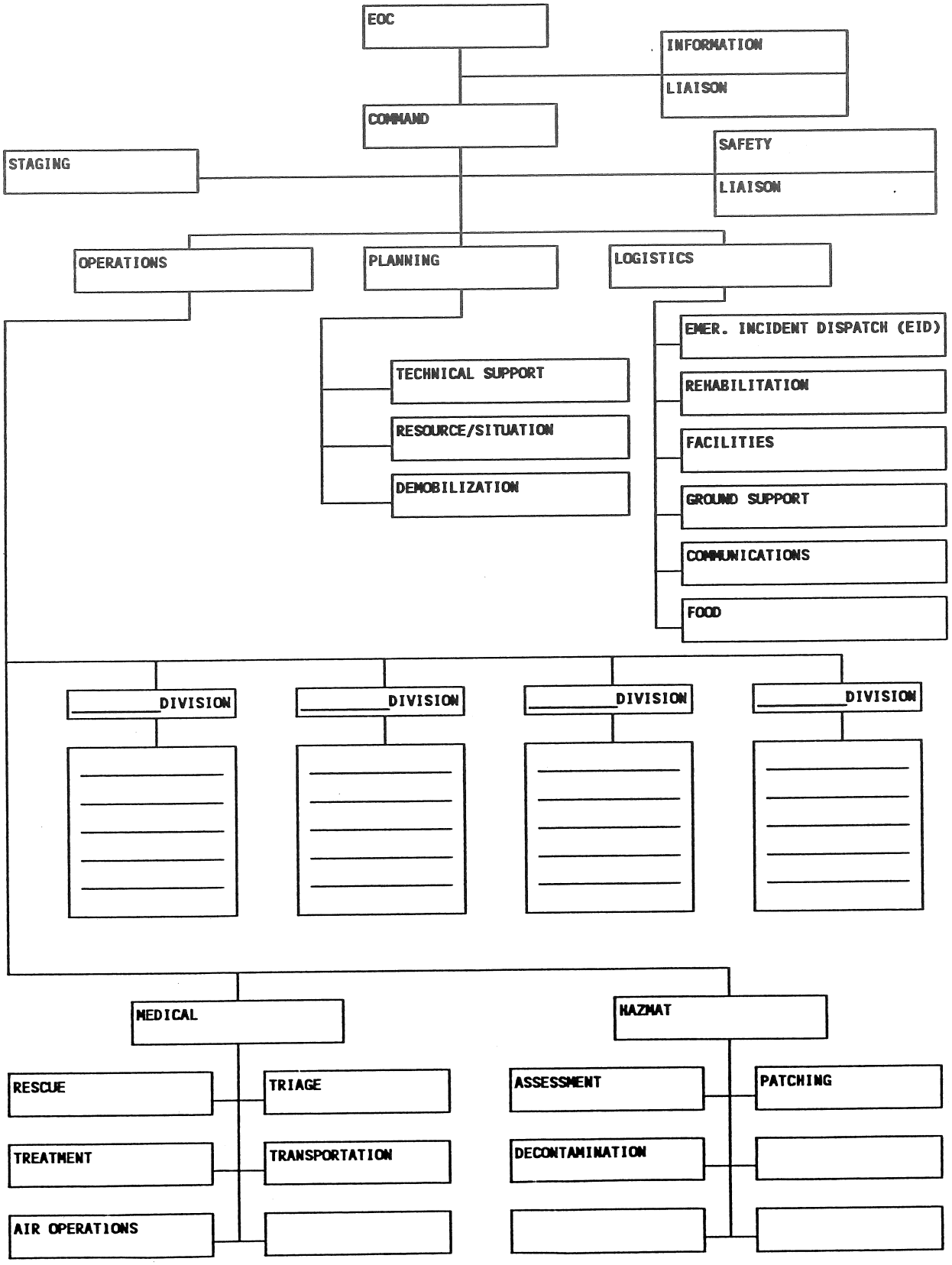
4. Suggest that the "Revised Fire Command" system resulting as the product of this applied research project be adopted as the Regional Incident Command System for the Corpus Christi Bay Area.

APPENDIX

CHANNEL INDUSTRIES MUTUAL AID ICS FORMS

- Emergency Organization Chart
- ICS Worksheet
- Resource Log
- Summary of Current Actions
- Staging Log
- Alarm List
- Apparatus Minumum Standards

CHANNEL INDUSTRIES MUTUAL AID
EMERGENCY ORGANIZATION CHART



CHANNEL INDUSTRIES MUTUAL AID
ICS WORKSHEET

IMMEDIATE CONCERNS
[ ] Personnel Accounted For
[ ] Product(s) Involved _____
[ ] MSDS or Other Hazard Information In-Hand

TACTICAL PRIORITIES
1. Rescue
2. Fire Control
3. Property Conservation

MULTIPLE CASUALTY
[ ] No. of Victims
[ ] Assign Medical Division
[ ] Request Ambulances (BLS/ALS)
[ ] Lifeflight Standby/Response (Assign Air Operations Division/LZ)
[ ] Obtain Bulk Supplies (Trauma, Backboards, O_2 Cylinders)
[ ] Heavy Equipment
[ ] Request Ambulances

First 10 Victims	3 ALS	4 BLS
For Each Additional 10	2 ALS	3 BLS

VAPOR RELEASE
[ ] Personnel Exposures Downwind
[ ] Traffic Isolated
[ ] Notification of Exposed (Municipal EOC, CIMA, CAER Line, News Media)
[ ] CAER ALERT (Level 1,2,3)
[ ] Nuisance, Shelter in Place, Evacuate
[ ] Mitigation of Release (Water Spray, Plug, Block In)
[ ] Downwind Monitoring

N
↑

Wind Direction
N
W E
S

PROCESS FIRE
[ ] Equipment Involved (Pump, Furnace, Piperack, etc.)
[ ] Process Liaison
[ ] Exposures Protected
[ ] Fixed Fire Prot. Activated (Deluges, Monitors, Foam Systems)
[ ] Process Isolated
[ ] Structural Stability
[ ] Power Isolated
[ ] Drainage Control
[ ] Hydrocarbons Floating on Water
[ ] Runoff Hazardous to Personnel
[ ] Fire Pump Status/Header Pressure

TANK FIRE
[ ] Tank Type _____ Tank Dia. _____
[ ] Tank Levels
[ ] Process Liaison
[ ] Exposures Protected
[ ] Fixed Fire Prt. Activated (Deluge, Monitor, Foam, Halon, CO_2)
[ ] Tank N_2 Inerted
[ ] Tank Static (No Pump-In or Pump-Out)
[ ] Drainage Control
[ ] Fire Pump Status/Header Pressure
[ ] Min. Foam Application Rate _____
[ ] Min. Conc. for 65 Minutes _____
[ ] Foam Coordination

CHANNEL INDUSTRIES MUTUAL AID
RESOURCE LOG

RESOURCE REQUESTED	TYPE *	REQUEST TIME	STAGED	DIVISION ASSIGNMENT	TIME	TIME RELEASED

Revised 2/10/90

*** RESOURCE ABBREVIATION FOLLOWED BY TYPE (e.g., "FE-1" would be a Type 1 Foam Engine)**

E = Engine
FT = Foam Tanker
FUEL = Fuel Tanker
FE = Foam Engine
DC = Dry Chemical
CREW = Manpower Group
A = Aerial
TA = Twin Agent
BA = Breathing Air
FA = Foam Aerial
AMB-A = Ambulance (ALS)
AMB-B = Ambulance (BLS)
FTR = Foam Trailer
R = Rescue
CV = Command Vehicle
L = Light Unit

CHANNEL INDUSTRIES MUTUAL AID
SUMMARY OF CURRENT ACTIONS

CHANNEL INDUSTRIES MUTUAL AID
STAGING LOG

STAGING LOCATION _____

				INFORMATION NOT NEEDED IF "TYPE" IS INDICATED					
RESOURCE ID	**RESOURCE TYPE ***	**CREW SIZE**	**FOAM TYPE**	**FOAM AMOUNT**	**PUMP SIZE**	**LDH HOSE SIZE & AMOUNT**	**LDH COUPLINGS SIZE & TYPE**	**SPECIAL EQUIPMENT**	**DIVISION ASSIGNMENT**

Revised 2/10/90

* RESOURCE ABBREVIATION FOLLOWED BY TYPE (e.g., "FE 1" would be a Type 1 Foam Engine)

E	= Engine	**FE**	= Foam Engine	**A**	= Aerial	**FA**	= Foam Aerial	**FTR**	= Foam Trailer
FT	= Foam Tanker	**DC**	= Dry Chemical	**TA**	= Twin Agen	**AMB-A**	= Ambulance (ALS)	**R**	= Rescue
FUEL	= Fuel Tanker	**CREW**	= Manpower Group	**BA**	= Breathing Air	**AMB-B**	= Ambulance (BLS)	**CV**	= Command Vehicle
								L	= Light Unit

CHANNEL INDUSTRIES MUTUAL AID
ALARM LIST

MEMBER NAME _____ **DATE** _____

	RESOURCE ID	RESOURCE TYPE
1ST ALARM		
2ND ALARM		
3RD ALARM		

*** RESOURCE ABBREVIATION FOLLOWED BY TYPE (e.g., "FE 1" would be a Type 1 Foam Engine)**

E	= Engine	**FE**	= Foam Engine	**A**	= Aerial	**FA**	= Foam Aerial	**FTR**	= Foam Trailer
FT	= Foam Tanker	**DC**	= Dry Chemical	**TA**	= Twin Agent	**AMB-A**	= Ambulance (ALS)	**R**	= Rescue
FUEL	= Fuel Tanker	**CREW**	= Manpower Group	**BA**	= Breathing Air	**AMB-B**	= Ambulance (BLS)	**CV**	= Command Vehicle
								L	= Light Unit

CHANNEL INDUSTRIES MUTUAL AID
APPARATUS MINIMUM STANDARDS

Resource (ID Abbrev.)	Components	Types			
		1	2	3	4
Engine (E)	Pump	1500	1000	1000	≤750
	Tank	500	500	500	≤500
	Hose LDH	1000'5"*	1000'5" *	--	--
	Hose 2½"- 3"	750'	750'	1000'	≤1000'
	Hose 1½"- 1¾"	600'	600'	600'	≤600'
	Heavy Stream	1000 gpm	1000 gpm	1000 gpm	--
	Personnel	4	4	4	4
Aerial (A)	Pump	1500	1000	1000	<1000
	Tank	--	--	--	--
	Hose LDH	1000'5"*	1000'5"*	--	--
	Hose 2½"- 3"	--	--	1000'	1000'
	Hose 1½"- 1¾"	--	--	--	--
	Elv. Stream	1250 **	1000 gpm	1000 gpm	<1000 gpm
	Personnel	4	4	4	4
	Height	75'	50'	<50'	Any Height
Foam Engine (FE) ***	Pump	1500	1000	1000	<1000
	Tank	1000	1000	1000	
	Hose LDH	1000'5"*	1000'5" *	--	--
	Hose 2½" - 3"	750'	750'	1000'	≤1000'
	Hose 1½"- 1¾"	600'	600'	600'	≤600'
	Heavy Stream	1000 gpm	1000 gpm	1000 gpm	--
	Personnel	4	4	4	4
Foam Aerial (FA) ***	Pump	1500	1000	1000	<1000
	Tank	500	500	500	<500
	Hose LDH	1000'5"*	1000'5" *	--	--
	Hose 2½" - 3"	750'	750'	1000'	≤1000'
	Hose 1½"- 1¾"	600'	600'	600'	
	Elevated Stream	1250 **	1000	1000	<1000
	Height	>75'	50'	<50'	Any Height
	Personnel	4	4	4	4

Explanations

* Engines carrying 5" hose should have hose coupled with either 5" Stortz or 4½" NST couplings. Adapters must be provided so that one supply line with either coupling can be hooked up on both supply and disharge side of pump.

Engines carrying 4" hose can be considered Type 1 provided that they: 1) Have a minimum of 1000', and 2) Have the necessary adapters to allow the hookup of two 4" lines on both the suction and discharge side of the pump, and to convert, if necessary, the couplings to either 5" stortz or 4 1/2" NST. Two 4" lines are necessary to obtain the same hydraulic equivalent as one 5" line.

** May be through one nozzle or may be split between two nozzles provided either flowrate is not less than 500 gpm.

*** A Foam Engine or Foam Aerial must have a foam proportioning system (balanced pressure or servo-command) that is capable of proportioning the water pump capacity at either 3 or 6 percent and be capable of transferring its foam concentrate load by pumping.

The intent is to be capable of pumping the rated capacity of foam solution through one large diameter line. If large diameter discharge is not present, suitable siamese must be provided.

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Resource	Components	Types			
		1	2	3	4
Foam Trailer (FTR)	Type System Personnel	Tank with self educting nozzle min. 500 gpm 4	Balanced-Pressure 4	Bladder Tank 4	
Foam Tanker (FT)	Tank Pump Personnel	4000 250 2	2000 250 2		
Dry Chemical (DC)	500 lbs. (Specify type D.C.)	Turret and Handlines min. 100'	Handlines only		
Twin Agent (TA)	500 lbs. D.C. 100 gal. Foam Solution (Premix or Proporoned)	Turret and Handlines min. 100'	Handlines only		
Ambulance BLS (AMB-B)	IFTB Approved Personnel 2				
Ambulance ALS (AMB-A)	IFTB Approved Personnel 2				
Rescue (R)	 Generator Air Cascade Elevated Rescue Confined Space Fixed/Port. Lighting Hydraulic (Heavy) Extrication Tools Light Extrication Chemical Suits Medical Equip. Stokes Excavation Rescue Air Bags Personnel	Heavy 10 KW Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes 4	Medium 5 KW Yes Yes Yes Yes Yes Yes No Yes Yes No No 4	Light 5 KW No No No Yes No Yes No Yes Yes No No 4	
Manpower (CREW)	4 Personnel with SCBA and Protective Clothing				
Fuel Tender (FUEL)	Specify Diesel, Gasoline, JP-4, JP-5				
Breathing Air (BA)		Cascade	Mobile Comp.		
Light Unit (L)	Generator with Floodlights				

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Resource	Components	Types			
		1	2	3	4
Command Vehicle (CV)	2 Mobile Radios CIMA 490 MHZ 1 Mobile Radio State Fire Mutual Aid HAHERN with digital dial Police Intercity Police Car to Car 2 Cellular Phones 1 Fax Unit 1 Computer with CIMA resource data base and chemical hazards data base and/or access to CHEMtrec HIT System 1 Printer Sit down space for 4 personnel Table				

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FOOTNOTES

1. Code of Federal Regulations. 29 CFR Part 1910 Hazardous Waste Operations and Emergency Response; Final Rule, (Washington, D.C., March 6, 1989), Sec. (q) (3) (i).

2. Farrior, Thomas, East Plant Emergency Response Plan, (Corpus Christi, TX, Champlin Refining Company, August, 1989).

3. Garcia, Daniel, Review of Valero's Incident Command System, (Corpus Christi, TX., Refinery Terminal Fire Company, November 16, 1989).

4. Brunacini, Alan V., Fire Command, (College Park, MD., YBS Productions, 1985).

5. IEMS News, What's Ahead for IEMS, (Washington, D.C., International Association of Fire Chiefs, February 1, 1990), p. A.

6. National Fire Academy. Incident Command System, (Emmitsburg, MD., National Emergency Training Center, October 31, 1988), p. xi.

7. Andrews, Jr., Robert C., Emergency Scene Management, (Kingsville, TX., Robert C. Andrews, Jr.), 1984.

8. Brunacini, Alan V., Andrews, Jr., Robert C., Stronach, R. Ian, "Emergency Management and Command School", A seminar (Terre Havte) Alcan Aluminum Limited, May 1-5, 1989.

9. Dimmick, Margaret, Implications of ICS for Integrated Emergency Management, (Washington, D. C., International Association of Fire Chiefs, IEMS News, April 15, 1990), p. B.

10. Dole, Elizabeth, "Phillips 66 Company Houston Chemical Complex Explosion and Fire - Implications for Safety and Health in the Petrochemical Industry - A Report to the President.", (Washington D. C., U.S. Department of Labor), April 1990.

11. Ibid. p. 10, 11, 12.

12. Ibid p. 27.

FOOTNOTES

13. National Fire Protection Association, Fire Command in Action, Video tape, (Batterymarch Park, Quincy, MA., NFPA, 1988).

14. National Fire Academy, Incident Command System, (Emmitsburg, MD., National Emergency Training Center, October 31, 1988), p. SM 1-9, SM 1-10, SM 1-11.

15. IAFC On Scene, NCCEM Supports Generic Incident Command System, (Washington D.C., International Association of Fire Chiefs, April 15, 1990) p.3.

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