REPORT

RAPPORT

27 10

Atomic Energy Control Board | Commission de contrôle de l'énergie atomique

Canada

INFO-0552

REPORT

Fire Fighting Capability Assessment Program Bruce B NGS

by

Fire Cross Consultants

Prepared for
the Atomic Energy Control Board
under its Regulatory Research
and Support Program
Ottawa, Canada

AECB Project No. 2.128.6

May 1995

Atomic Energy Control Board | Commission de contrôle de l'énergie atomique

Canada

FIRE FIGHTING CAPABILITY
ASSESSMENT PROGRAM - BRUCE B NGS

A report prepared by Fire Cross Consultants Incorporated, under contract to the Atomic Energy Control Board.

ABSTRACT

This is a report on the completion of work relating to the assessment of the capability of Bruce B NGS to cope with a large fire incident. This included an evaluation of an exercise scenario that would simulate a large fire incident and of their fire plans and procedures. Finally the execution of fire plans by Bruce B NGS, as demonstrated by their application of human and material resources during a simulated large fire, was observed.

The fire fighting equipment and the personal protective clothing and associated equipment that was in use was all of good quality and in good condition. There had also been notable improvement in communications equipment. Similarly, the human resources that had been assigned to fire fighting and rescue crews and that were available were more than adequate. Use of a logical incident command system, and the adoption of proper policy and procedures for radio communications were equally significant improvements. Practice should correct the breakdowns that occurred in these areas during the exercise. As well, there remains a need for the development of policy on fire fighting and rescue operations with more depth and clarity.

In summary, the key point to be recognized is the degree of improvement that has been realized since the previous evaluation in 1990. Clearly the Emergency Response Teams organization of Bruce B NGS is evolving into an effective fire fighting force. Providing that the deficiencies identified in this report are addressed satisfactorily, *Fire Cross* is confident that the organization will have the capability to provide rescue and fire fighting services that will satisfy the need.

RÉSUMÉ

Le présent document constitue un compte rendu de la dernière étape des travaux destinés à évaluer la capacité de la centrale de Bruce B à faire face à un incendie majeur. Ces travaux ont comporté l'évaluation d'un exercice simulant un grand incendie et des plans et procédures établis par la centrale pour faire face à un tel sinistre. Enfin, on a évalué la mise en application des plans de protection-incendie de la centrale nucléaire de Bruce B, par l'observation de l'utilisation faite des ressources humaines et matérielles au cours de l'exercice de simulation.

Le matériel de lutte contre l'incendie, les vêtements de protection individuels de même que le matériel connexe utilisé étaient de qualité adéquate et en bon état. Des progrès appréciables ont été constatés sur le plan de la qualité du matériel de communication. De plus, les personnes ayant participé aux opérations de sauvetage et de lutte contre l'incendie se sont

comportées de façon plus que satisfaisante. Le recours à un système de commandement en cas d'intervention et l'adoption de politiques et de procédures appropriées en matière de communications radio ont aussi constitué des améliorations notables. Une fois qu'on se sera mieux familiarisé avec ces système, politiques et procédures, les problèmes survenus quant à leur utilisation devraient disparaître. De plus, il demeure nécessaire d'élaborer des politiques plus claires et plus détaillées en matière de sauvetage et de lutte contre les incendies.

En résumé, les progrès réalisés depuis la dernière évaluation, en 1990, constituent le principal point à retenir. Il est évident que l'organisation d'urgence de lutte contre l'incendie à la centrale de Bruce B s'affirme de plus en plus comme une équipe efficace. Pourvu que les lacunes relevées dans le présent rapport soient corrigées de façon satisfaisante, *Fire Cross* est convaincue que l'organisation saura offrir des services de sauvetage et de lutte contre l'incendie répondant aux besoins.

FIRE FIGHTING CAPABILITY ASSESSMENT PROGRAM - BRUCE B NGS

EXECUTIVE SUMMARY

The work was undertaken under the provisions of a contract for Atomic Energy Control Board (AECB) Project 2.128.6, "Review of a Fire Drill at Bruce B Nuclear Generating Station" (Bruce B NGS). The key components of the work were: to ensure agreement by all concerned on the previously recorded definition of "large fire" as such applies to a Nuclear Generating Station (NGS); to review and assess the plans of Bruce B NGS for coping with a large fire incident; to evaluate the capability of Bruce B NGS to deal with a large fire; and to report on these matters.

Agreement on the definition of a "large fire" was achieved quickly and without any evidence of dissent. Following this, the exercise scenario prepared by Ontario Hydro was reviewed. Where warranted by circumstances, suggested changes to the scenario were forwarded to AECB. The scenario was also discussed some time later during a meeting called for the purpose and attended by representatives of Ontario Hydro, the AECB and *Fire Cross Consultants Inc. (referred subsequetly as Fire Cross).* What evolved was agreed to by all.

As a means of determining the level of preparedness of Bruce B NGS for dealing with a "large fire", the second phase of the work called for the study and evaluation of their plans for fire fighting. On receipt of the plans which were contained in a manual titled "Bruce B Emergency Response Manual" a detailed study of the three parts that related directly to fire fighting was undertaken. These parts were titled: Fire Procedures - Reference Section; Emergency Response Teams (ERT) Communications; and Fire Response Procedures - Action Guides. The Action Guides section consisted, in the main, of a series of flow charts depicting step by step actions required of designated persons. Essentially check lists in graphic format. As well, oversights on matters of pivotal importance were recognized. This was the case for both the Shift Emergency Response Coordinator (SERC), who serves in the role of Incident Commander, and for ERT Captains. This is reflected more explicitly through additions inserted by *Fire Cross* and identified as such on pages C-11 and C-13 of Appendix C. The Fire Procedures - Reference Section, despite its title, was almost exclusively devoted to fire protection policy on administrative matters and technical matters regarding human resources and material resources, little of which directly related to fire fighting and rescue operations. The section on ERT Communications was good. Overall there was very little in the way of policy on fire fighting and rescue operations.

In light of the foregoing, an extensive report containing material for use in addressing this serious void was prepared and submitted to AECB approximately two months prior to the evaluation exercise. This report, with minor additions made following the exercise, is included at Appendix C. It was pleasing to note that on the day of the exercise Ontario Hydro provided a copy of newly developed Standard Operating Guidelines (SOG) for a number of fire fighting and rescue operations. Although not of themselves a replacement for an operations policy manual, they were nevertheless well considered and useful.

It should be noted that a fire safety plan, as such is defined in both the National Fire Code of Canada and the Ontario Fire Code was not provided for review.

The method used to evaluate the ability of Bruce B NGS to mount effective fire fighting and rescue operations was to observe a fire fighting and rescue exercise, based on the agreed upon scenario for a large fire incident, that was held at the Bruce B NGS plant on November 22, 1994. In doing this, the resources committed to fire fighting and rescue and their application were assessed by four members of *Fire Cross* immediately prior to, during and immediately after the exercise. Observations made during this exercise are reflected throughout this report.

The scope of the scenario for the simulated fire fighting and rescue exercise was sufficient to simulate the occurrence of a "large fire". The location of the simulated fire was to be in Unit 5. In support of this the Exercise Controllers had all necessary props in place for the scheduled start time of 0900 hours. A mechanical problem with Unit 5 forced the relocation of the incident to Unit 8. This imposed a delay of approximately two hours. A simulated leaking of hydrogen and oil from the outboard hydrogen seal on Unit 8 on elevation 615 was the first step in initiating the exercise. Ignition was simulated to have occurred in the leaked hydrogen which in turn ignited the leaking oil. The scenario then called for the leaking oil, now burning, to descend through steel floor grates and to accumulate and burn on elevation 591. As the exercise progressed the fire spread to other fuels. Elevation 591 was the site of the main fire.

Mechanically generated smoke, flashing lights, lettered signs, casualty simulation and flip charts were the primary methods used to provide information to emergency responders. All of these components worked well. In fact the flip charts worked all too well, in that they not only provided information on the evolution of the fire but also provided a listing of actions required of the fire crew. This detracted from the authenticity of the evaluation since the Exercise Controllers, no doubt inadvertently, essentially became Fire Crew Supervisors.

There was one gap of substance between the scenario and the supportive inputs. This was the fire involving hydrogen and oil on elevation 615 which was more or less abandoned insofar as follow up inputs were concerned.

The apparent lack of confidentiality of the exercise plans was also of concern. Having recognized this, it is also recognized that although it is something that needs to be pursued vigorously, it can only be achieved to a limited degree.

At approximately one minute after the announcement on the public address system that there was a fire in Unit 8 members of the ERT began to assemble in the "Base" room designated for the purpose. One of the first to arrive was a Shift Emergency Response Coordinator (SERC) who assumed the duties and responsibilities of Incident Commander as the first step in the implementation of the incident command system. He quickly put on conspicuous identification, assigned a scribe to support "Base"/Command Post operations and began forming teams, assigning specific tasks and dispatching them to the incident.

The expeditious manner in which the above was done was impressive. As the exercise progressed however, it became increasingly evident that the Incident Commander was making tactical decisions based on very limited information about the incident. This practice continued until the appointment of a Sector Officer some 35 minutes after the alarm of fire. Further, the Incident Commander did not visit the incident scene to assess the situation. During the period leading up to this the Captains involved in on scene operations were reporting directly to the Incident Commander.

At one point during the exercise a Field Captain attempted to coordinate on-scene operations which, under the circumstances, was commendable. It was however neither initiated by nor communicated to the Incident Commander. Other crew members on the scene, particularly other Captains were therefore unaware of the attempted change. There was therefore no effective coordination of on-scene fire fighting and rescue activities.

Fire fighting and rescue operations, lacking effective command and control were therefore not as effective as they should have been. More specifically, the size-up and primary search functions were not done as quickly or as thoroughly as is expected for these important tasks. In addition hose lines were often kinked in such a way as might be expected to compromise the effectiveness of the fire attack. This was the case for both water hose lines and dry chemical hose lines. There was no evidence that the need to ventilate was a factor being considered.

Casualty care on the other hand was excellent. At times it was evident that this was achieved at the expense of other tasks such as size-up, primary search and fire fighting. The practice of giving first priority to providing first aid to the injured is not questioned. The problem was that, once a task was interrupted, it was not subsequently pursued with the same sense of purpose. This resulted in sizable delays in conducting primary search operations and fire fighting operations.

The fire fighting equipment and the personal protective clothing and associated equipment that was in use was all of good quality and in good condition. There had also been notable improvement in communications equipment. Similarly, the human resources that had been assigned to fire fighting and rescue crews and that were available were more than adequate. It provided for a full compliment for direct involvement in simulated fire fighting and rescue operations as well as an ample contingent in reserve.

The improved communications equipment did not eliminate the persistent problem of poor quality reception of messages transmitted by radio. This was of course largely influenced by the environment presented by a steel and concrete building. The other deficiency of substance in the area of communications was the breakdown of radio discipline as the exercise progressed. Failure to use identifying call signs and to acknowledge messages received occurred frequently.

In summary, the key point to be recognized is the degree of improvement that has been effected since the previous evaluation in 1990. To identify an area that most emphatically illustrates this, casualty care comes quickly to mind. Clearly the condition of an injured person was most unlikely to worsen once found by the emergency responders. Aid that was provided to the injured was outstanding. Regrettably there was also a serious shortcoming in this area in that both size-up and primary search was so ineffective that some casualties were not found for an extended period. In one case this unacceptable delay would almost assuredly have resulted in the life of one person being threatened, not from injuries, but from extended exposure to the hostile environment.

Use of a logical incident command system, and the adoption of proper policy and procedures for radio communications were equally significant improvements. Practice should correct the breakdowns that occurred in these areas during the exercise. Conversely there remains a need for the development of policy on fire fighting and rescue operations with more depth and clarity than the flow chart arrangement that was in place. Also worthy of note was the significant improvements that had been made to the fire fighting and rescue training centre at Bruce NGS.

The only resources, external to Bruce NGS that attended the incident scene was a simulated municipal ambulance. Another resource, the fire crews of the Tiverton Fire Department responded and were held on stand-by at the Bruce B gate. In addition, resources external to Bruce B NGS, including Bruce A NGS ERT and Bruce NGS "Site" ERT were called. The latter, by setting up a pumper to produce foam and extending two hose lines to the perimeter of the scene through door #4, demonstrated the potential for effective fire suppression but were not assigned tasks of any kind.

FIRE FIGHTING CAPABILITY ASSESSMENT PROGRAM - BRUCE B NGS

TABLE OF CONTENTS

LIST OF ACRONYMS

AECB	-	Atomic Energy Control Board
ANO	-	Authorized Nuclear Operator
BCMFAA	-	Bruce County Mutual Fire Aid Association
CER	-	Control Equipment Room
CP	-	Command Post
EOC	-	Emergency Operating Centre
EPC	-	Emergency Preparedness Coordinator
ERM	-	Emergency Response Manual
ERT	-	Emergency Response Team
IPC	-	In Plant Coordinator
IC	-	Incident Commander
MCC	-	Mortal Control Centre
MCR	-	Main Control Room
MHZ	-	Megahertz
NGS	-	Nuclear Generating Station
NIS	-	Non-Incident Station
NISSS	-	Non-Incident Station Shift Supervisor
NWESD	-	Nuclear Waste and Environmental Services Division
OPC	-	Out of Plant Coordinator
OSS	-	On-Scene Supervisors
OSST	-	Off-Site Survey Team
PA	-	Public Address (System)
PASS	-	Personal Alert Safety System
SCBA	-	Self Contained Breathing Apparatus
SERC	-	Shift Emergency Response Coordinator
SNO	-	Senior Nuclear Operator
SOG	-	Standard Operating Guideline
SOS	-	Shift Operating Supervisor
SS	-	Shift Superintendent
SSIT	-	Shift Supervisor in Training
SSS	-	Shift Safety Superintendent
T&DFD	-	Tiverton and District Fire Department
UANO	-	Unit Authorized Nuclear Operator
UZDO	-	Unit Zero Desk Operator

1. INTRODUCTION

The assessment of the fire plans of Bruce B NGS and the observation of an exercise involving a simulated large fire to gauge their probable effectiveness in dealing with a genuine emergency of such magnitude was conducted under the provisions of AECB Project No.2.128.6

The results of the work have been compiled and presented in such a way as to provide an executive summary and individual sections on six main subject areas followed by a section on conclusions and recommendations. As well, additional information is included in four appendices.

2. METHODOLOGY

The first step in the process of completing this work was to ensure there was agreement and acceptance by Ontario Hydro of the definition of a "large fire" as such has been defined for nuclear generating stations at Appendix B. Following this, the exercise scenario prepared by Ontario Hydro was reviewed. Where warranted by circumstances, suggested changes to the scenario were forwarded to Atomic Energy Control Board (AECB). Some time later a meeting attended by representatives of Ontario Hydro, AECB and *Fire Cross* was held at BNGS to discuss the adjusted scenario. During this visit nuclear radiation safety training was provided to *Fire Cross* by Bruce B Nuclear Generating Station (BNGS B).

As a means of determining the level of preparedness of BNGS B for dealing with a "large fire", the second phase of the work called for the study and evaluation of their plans for fire fighting. Accordingly, on receipt of the plans they were studied carefully and a report containing extensive recommendations for improvements was compiled and submitted to AECB on September 29, 1994.

The method used to evaluate the ability of BNGS B to mount effective fire fighting and rescue operations was to observe a fire fighting and rescue exercise, based on the agreed upon scenario, at the BNGS B plant. Observations made during this exercise are reflected throughout this report.

3. SCENARIO

The scope of the scenario for the simulated fire fighting and rescue exercise was sufficient to simulate the occurrence of a "large fire". The location of the simulated fire was to be in Unit 5. In support of this the Exercise Controllers had all necessary props in place for the scheduled start time of 0900 hours. A mechanical problem with Unit 5 forced the relocation of the incident to Unit 8. This imposed a delay of approximately two hours. A simulated leaking of hydrogen and oil from the outboard hydrogen seal on Unit 8 on elevation 615 was the first step in initiating the exercise.

After a deliberately scheduled time delay of four minutes to allow leaked oil to accumulate on elevation 591, the hydrogen was declared to have ignited and therefore became the first fuel involved. This fire was simulated to have activated a wet pipe sprinkler system and to have ignited the leaking oil at elevation 615. The leaking oil, now burning, descended through steel floor grates to elevation 591. All subsequent simulation was keyed to this start point. It may be noted that, due to the incident site being relocated from Unit 5 to Unit 8, the extension of fire to radioactive waste could not be simulated. For further information the full scenario is attached at Appendix A.

Mechanically generated smoke, flashing lights, lettered signs, casualty simulation and flip charts were the primary methods used to provide information to emergency responders. All of these components worked well. In fact the flip charts worked all too well, in that they not only provided information on the evolution of the fire but also provided a listing of actions required of the fire crew. This detracted from the authenticity of the evaluation since the Exercise Controllers, no doubt inadvertently, essentially became Fire Crew Supervisors.

There was one gap of substance between the scenario and the supportive inputs. This was the fire involving hydrogen and oil on elevation 615 which was more or less abandoned insofar as follow up inputs were concerned. Another item, the apparent lack of confidentiality of the exercise plans was also of concern. Having recognized this, it is also recognized that although it is something that needs to be pursued vigorously, it can only be achieved to a limited degree.

4. PLANS

A review of those sections of Bruce B Emergency Response Manual (ERM) that related to fire fighting and associated rescue operations was conducted. The primary aim was to evaluate the scope and clarity of fire fighting plans and the suitability of fire fighting strategy prepared by Ontario Hydro for the Bruce B Nuclear Generating Station. As an extension to this, if any changes were found to be required and useful, a further aim was to develop appropriate recommendations to the AECB. The study was therefore based on these precepts. As an adjunct to this a cross section of pre-fire plans which featured floor plans on one side and pertinent information on the other were reviewed and found to be useful support for response to fire emergencies.

The manual had three parts that related to fire matters. These parts were titled: Fire Procedures -Reference Section; ERT Communications; and Fire Response Procedures - Action Guides. The review was therefore limited to these portions. The Action Guides section consisted, in the main, of a series of flow charts depicting step by step actions required of designated persons. Essentially they were check lists in graphic format. These were found too cumbersome to deal with and had oversights of pivotal importance, particularly on matters relating to command and control. The Fire Procedures - Reference Section, despite its title, was almost exclusively devoted to fire protection policy on administrative matters and

technical matters regarding human resources and material resources.

One segment, identified as "5.0 - Emergency Personnel Roles & Responsibilities", although the contents were also mainly administrative there were some passages that dealt with emergencies. When this was so, it tended to be in conflict with the Action Guides and the Incident Command system in principle. The section on ERT Communications was good. Overall there was very little in the way of policy on fire fighting and rescue operations.

In light of the foregoing an extensive report, containing material for use in addressing this serious void, was prepared and submitted to AECB approximately two months prior to the evaluation exercise. This report, with minor additions made following the exercise, is included at Appendix C. As a means of positively identifying oversights in the duties and responsibilities assigned to specific positions, a summary of the plans was compiled and the overlooked items inserted at the point where they might logically fit in the plans. All insertions have been appropriately identified as such. Typical examples of this are shown at Appendix C, pages C-11 and C-13. It was pleasing to note that on the day of the exercise Ontario Hydro provided a copy of newly developed Standard Operating Guidelines (SOG) for a number of fire fighting and rescue operations. Although not of themselves a replacement for an operations policy manual, they were nevertheless well considered and useful.

It should be noted that a fire safety plan, as such is defined in both the National Fire Code of Canada and the Ontario Fire Code was not provided for review.

5. EQUIPMENT

The equipment provided for fire fighting and rescue was excellent. The protective clothing was of good quality and was stored neatly in readily accessible racks in the Emergency Response Teams (ERT) Room. There was an adequate supply of self contained breathing apparatus (SCBA). Those for use by members with command and control responsibilities included up to date radio communications features. Fully charged spare cylinders of breathing air were correctly stored in the upright position on a cart provided for that purpose.

Fire carts were strategically located throughout the plant. Each carried a suitable mix of equipment, all of which was in good condition. The contents of each cart was conveniently listed on the outside of a compartment door.

6. PERSONNEL

The human resources that had been assigned to fire fighting and rescue crews and that were available were more than adequate. It provided for a full complement for direct involvement in simulated fire fighting and rescue operations as well as an ample contingent in reserve.

Reports on the manning levels of the Emergency Operations Centre (EOC) and ERT "Base" were that sufficient personnel had been assigned. Assignments made by the Incident Commander (IC) who used ERT "Base" as Command Post (CP) included the following.

a. Team 1 - Incident "Size Up";
b. Team 2 - Fire fighting;
c. Team 3 - Attend to casualty #1, elevation 591;
d. Team 4 - Fire fighting using a 350 lb dry chemical fire extinguisher;
e. Team 5 - Primary search of elevations 615 and 639;
f. Team 6 - Attend to casualty #2, elevation 519;
g. Team 7 - Fire fighting;
h. Team 8 - Attend to casualty #3 at elevation 639; and
i. Sector Officer - Assigned to elevation 591.

In addition to these teams, individual ERT members were given other assignments. Further, a Bruce "Site" fire fighting and rescue crew were assigned to connect their pumper to an external fire hydrant and to extend a foam line to the fire on elevation 591.

Reserves consisted of two vehicles and six crew members from the Tiverton Volunteer Fire Department and the ERT personnel of Bruce A.

7. COMMUNICATIONS

It was noted that there had been major improvements made to the radio equipment of the ERT with the introduction of Com-1 headsets in the protective clothing of members with command and control responsibilities. This provided improved communications between all such personnel, including the Incident Commander who also had a headset and microphone. The new equipment did not eliminate the intermittent reception that was frequently experienced. Although this continues to be an area of concern, it is recognized that operating within a steel and concrete building imposes significant limitations on radio communications.

It was observed that radio procedures, as given in the section on ERT communications contained in the Emergency Response Manual (ERM), were not being followed consistently. Radio messages often began without the use of an identifying call sign and terminated without any acknowledgement from the intended recipient. In circumstances where acknowledgement that a message has been received is not forthcoming in a routine manner as it should, it is the responsibility of the person originating the message to seek that acknowledgement.

The lack of a common radio frequency for use by the fire fighting services of Bruce A, Bruce B, Bruce "Site", and the Bruce County Mutual Fire Aid Association (BCMFAA) was a significant shortcoming. Typical of the difficulties this imposes was the fact that when Bruce "Site" arrived at the incident they were unable to obtain information or get direction from the

command structure that was in place. As a result they were never effectively used nor could they be given any information that might be needed to protect their well being and safety. The deficiency also created the additional task of having Bruce B portable radios provided for other responders. The need to obtain a common radio frequency for the use of all fire fighting and rescue organizations has perviously been identified as a basic requirement for the conduct of joint operations. The need remains.

8. OPERATIONS

8.1 Overview

The key point to be recognized is the degree of improvement that has been effected since the previous evaluation in 1990. To identify an area that most emphatically illustrates this, casualty care comes quickly to mind. Clearly the condition of an injured person was most unlikely to worsen once found by the emergency responders. Aid that was provided to the injured was outstanding. Regrettably there was also a serious shortcoming in this area in that both size-up and primary search was so ineffective that some casualties were not found for an extended period. In the case of the casualty on elevation 615 this unacceptable delay resulted in the injured person being left in a life threatening situation from extended exposure to the hostile environment.

The calibre of resources, both human and material, that were dedicated to fire fighting and rescue lent further support to the fact that significant improvements have been achieved and that further improvements required only continued effort. As stated earlier, the comments contained in the report, most particularly the section on conclusions and recommendations, and Appendix C - "A Review of Bruce B NGS Fire Plans", are intended to serve as support for the improvements that are needed.

The only resources, external to BNGS that attended the incident scene was a simulated municipal ambulance. Another resource, the fire crews of the Tiverton Fire Department responded and were held on stand-by at the Bruce B gate. In addition, resources external to BNGS B, including BNGS A ERT and BNGS "Site" ERT were called. The latter, for example, demonstrated the potential for effective fire suppression but were not assigned tasks of any kind.

8.2 ERT "Base"

As provided for in the ERM, Standard Operating Guidelines 09011.81 and Fire Response Procedure - Action Guide 09011.1, after the sounding of the fire siren all duty ERT personnel reported to room S227.

At approximately one minute after the announcement on the public address system (PA) that the fire was in Unit 8 the ERT members began to assemble. One of the first to arrive was a

SERC who assumed the duties and responsibilities of Incident Commander. The Incident Commander selected ERT "Base" as the location for Command Post which was a logical choice.

In addition to the assembly and accounting of ERT personnel, the assignment of teams to their primary duties was done from this location by the Incident Commander. The donning of personal protective clothing and SCBA by ERT personnel was also done in this room.

To support ERT "Base" operations a scribe was designated. The duties of the Scribe which were posted adjacent to the "Base Station" radio desk included:

1. Clear Radio; (Designating the channel(s) to be used by emergency responders.)
2. Update boards;
3 Initiate and maintain log;
4. Inform the In Plant Coordinator (IPC) when ERT accounting is complete;
5. Monitor radio communications;
6. Assist the IC as required; and
7. Other emergency duties as dictated by circumstances.

These posted guidelines reflect the main duties and responsibilities contained in Standard Operating Guideline (SOG) #5 titled Scribe Duties.

Overall operations at ERT "Base"/Command Post were conducted in such a manner that created the proper atmosphere for effective operations. Personnel assigned to perform these functions did so in a competent manner.

8.3 Incident Command

The incident command system was implemented approximately one minute after the sounding of the alarm of fire when the first SERC to arrive at the ERT room assumed the role of Incident Commander (IC). He quickly put on conspicuous identification and began forming teams and dispatching them to the incident. Team One was directed to Unit 8, elevation 591 to perform a size-up. The second team was directed to take a fire cart and to establish a staging area on elevation 591 between Unit 7 and Unit 8. At this point it was evident that the IC was making tactical decisions based on a very limited amount of information. This practice continued until the appointment of a Sector Officer some 35 minutes after the alarm of fire. During the period leading up to this the Captains involved in on scene operations were reporting directly to the IC. There was therefore no effective coordination of fire fighting and rescue activities during this period.

The initial size-up team, on arrival at the scene, immediately came upon one casualty who had suffered serious injuries and shortly thereafter a second casualty in great distress close to the oil fire. The team immediately directed their efforts towards the higher priority task of rendering first aid to the injured. This was as it should be, however the interrupted size-up

was not reorganized and thoroughly conducted.

The team that had been assigned to establish a staging area between Units 7 and 8 on elevation 591 arrived at the location with a fire cart but left the area to assist in fire fighting and rescue. Command and control was very imprecise at this point. Interestingly the SOG issued November 13, 1994, a copy of which was passed to *Fire Cross* on the day of the exercise, addresses several of the areas found to be deficient. In this regard SOG #18, Incident Command outlines the command structure to be used to conduct fire fighting and rescue operations whether for large or small incidents. Basically responsibilities are assigned as follows:

Incident size.	Operations category.	Assigned to.
Small	Strategy	Incident Commander
	Tactics	Incident Commander
	Tasks	Field Captains
Large	Strategy	Incident Commander
	Tactics	Sector Officer
	Tasks	Field Captains

Evidently the IC operated under the small incidents methods until some 35 minutes after the alarm of fire at which time he appointed a Sector Officer.

The SOG referred to above also specifies that "The general rule of 5 - No one will have more than five direct reports to them, will be followed at all times ". This rule was not complied with by the IC who had as many as 8 teams reporting directly to him prior to the appointment of a Sector Officer.

At one point during the exercise a Field Captain attempted to coordinate on-scene operations which under the circumstances was commendable. It was however neither initiated by nor communicated to the IC. Other crew members on the scene, particularly other Captains were therefore unaware of the attempted change.

8.4 Fire Fighting and Rescue

Fire fighting and rescue operations, lacking effective command and control, were not as effective as they should have been. More specifically, the size up and primary search were not done either as quickly or as thoroughly as they should have been. In addition hose lines were often kinked in such a way as might be expected to compromise the effectiveness of the fire attack. This was the case for both water hose lines and dry chemical hose lines.

Casualty care on the other hand was excellent. At times it was evident that this was achieved at the expense of other tasks such as size-up, primary search and fire fighting. The practice

of giving first priority to providing first aid to the injured is not questioned. The problem was that, once a task was interrupted, it was not subsequently pursued with the same sense of purpose. This resulted in sizable delays in conducting primary search operations and fire fighting operations. For example there was no response to the fire on elevation 615 until approximately 25 minutes after the alarm of fire was sounded. At that point 3 crew members arrived and extended a hose line from a standpipe at which time they observed a casualty with electrical burns to the hands and feet. After some discussion all three abandoned fire fighting and undertook to treat the casualty. In this case, due to the minor nature of the injuries, both functions could have been conducted simultaneously. It was a further 9 minutes, for a total of 34 minutes after the fire alarm before a 350 lb dry chemical wheeled unit extinguisher was brought into action on the oil fire.

The situation on elevation 591 included a pool of oil as the principal fuel. Despite the fact that a fire cart with foam concentrate and foam producing equipment on board had been brought to the area, foam was not used. The first indication of a foam producing capability occurred some 40 minutes into the exercise when the Bruce "Site" ERT approached the scene through door #4. Even at this point its usage was not simulated. The reason this was so is believed to be the result of the Exercise Controllers having lined out the requirement for foam application on the flip charts described in Section 3.

9. CONCLUSIONS and RECOMMENDATIONS

The key point to be recognized is the degree of improvement that has been effected since the previous evaluation in 1990. To identify an area that most emphatically illustrates this, casualty care comes quickly to mind. Clearly the condition of an injured person was most unlikely to worsen once found by the emergency responders. Aid that was provided to the injured was outstanding. Regrettably there was also a serious shortcoming in this area in that both size-up and primary search was so ineffective that some casualties were not found for an extended period. In one case this unacceptable delay would almost assuredly have resulted in the life of one person being threatened, not from injuries, but from extended exposure to the hostile environment.

Use of a logical incident command system, and the adoption of proper policy and procedures for radio communications were equally significant improvements. Practice should correct the breakdowns that occurred in these areas during the exercise. Conversely there remains a need for the development of policy on fire fighting and rescue operations with more depth and clarity than the flow chart arrangement that was in place. Also worthy of note was the significant improvements that had been made to the fire fighting and rescue training centre at BNGS.

The only resources, external to BNGS that attended the incident scene was a simulated municipal ambulance. Another resource, the fire crews of the Tiverton Fire Department responded and were held on stand-by at the Bruce B gate. In addition, resources external to BNGS B, including BNGS A ERT and BNGS "Site" ERT were called. The latter, by setting up a pumper to produce foam and extending two hose lines to the perimeter of the scene through door #4, demonstrated the potential for effective fire suppression but were not assigned tasks of any kind.

9.1 General

The following individual conclusions are essentially the identification and description of matters requiring the attention of the licensee. The recommendations outline the direction that this attention should take. In all cases care was taken to ensure that any recommended course of action offered a practical solution that is achievable.

9.2 Scenario - Scope and Clarity

9.2.1 Conclusion

It is concluded that the scenario had sufficient scope to simulate a "large fire". It did not however provide appropriate inputs on the hydrogen fuelled fire that was the fire used to initiate the exercise.

9.2.2 Recommendation

It is recommended that care be exercised by Exercise Controllers in the development and use of exercise inputs to ensure there is a high degree of continuity from its beginning to its termination.

9.3 Scenario - Controller Inputs

9.3.1 Conclusion

It is concluded that the use of a large flip chart, which was positioned within the simulated fire, was an effective means of providing descriptions of the evolution of the incident. It was further concluded that the inclusion of a listing of actions required of the fire crews detracted from the authenticity of the evaluation.

9.3.2 Recommendation

It is recommended that the use of flip charts be continued where necessary to describe a situation or condition being simulated but that they should not be used to prompt or provide direction to emergency responders.

9.4 Plans - Conversion of Action Guides to Descriptive Text

9.4.1 Conclusion

It is concluded that the Action Guides section of the Emergency Response Manual, which were arranged in series of flow charts depicting step by step actions required of designated persons, was cumbersome to use and did not identify and assign some important responsibilities. Some of these items are shown in Appendix C, pages C-11 and C-13.

9.4.2 Recommendation

It is recommended that the Action Guides be converted to descriptive text, that care be exercised to ensure all important responsibilities are assigned in a logical manner and that particular care be exrcised to ensure that the results are in keeping with the principles of the Incident Command System.

9.5 Plans - Emergency Personnel Roles & Responsibilities

9.5.1 Conclusion

It is concluded that although the contents of the segment of the Emergency Response Manual, Reference Section identified as "5.0 - Emergency Personnel Roles & Responsibilities" were mainly administrative in nature, there were a number of passages that dealt with emergencies. It was further concluded that where this was so, it tended to be in conflict with the Action Guides and with the Incident Command System in principle.

9.5.2 Recommendation

It is recommended that these deficiencies be addressed as part of the broader goal of compiling a Policy Manual on Fire Fighting and Rescue Operations.

9.6 Plans - Management and Administration, ERT

9.6.1 Conclusion

It is concluded that the degree that responsibility for management and administration of ERT was dispersed among several positions, as reflected in the EMR, was excessive and that this had the potential of detracting from the effectiveness of this important group. It was further concluded that the In-Plant Coordinator had the broadest range of involvement.

9.6.2 Recommendation

It is recommended that a study be undertaken to address this issue with the aim of consolidating the management and administration of ERT under a single position title.

9.7 Communications - General

9.7.1 Conclusion

It is concluded that, although it was evident that the Incident Commander and others were conscious of the need to, when appropriate, use some means of communications other than radio during the emergency, radio traffic was nevertheless frequently congested. It was further concluded that there was opportunity for expanded use of means of communication other than radio.

9.7.2 Recommendation

It is recommended that this matter be given attention during routine training exercises with the aim of reducing the use of radio communications insofar as is practicable. For example status reports could be made by telephone.

9.8 Communications - Common Radio Frequency

9.8.1 Conclusion

It is concluded that the lack of a common radio frequency for use by both on-site and off-site fire fighting and rescue organizations would have a detrimental effect on joint operations.

9.8.2 Recommendation

it is recommended that Ontario Hydro be asked to take a lead role in satisfying this critical requirement

9.9 Communications - Radio Operating Procedures

9.9.1 Conclusion

It is concluded that the failure of some radio users to acknowledge receipt of a message made it impossible to determine whether or not it had been received. It was further concluded that in some case where the structure of a transmission did not provide a recognizable cue that it was completed, the use of the term "over", or in a very limited number of situations the term "out", when a message is finished is required. In some cases this was not done which caused some delays.

9.9.2 Recommendation

It is recommended that precise radio discipline be practiced.

9.10 Communications - Use of Radio "Call Signs"

9.10.1 Conclusion

It is concluded that the omission of "call signs" from radio communications, which became prevalent as the exercise progressed, introduced the potential for confusion and delays in that it was not always clear who was transmitting .

9.10.2 Recommendation

It is recommended that good radio procedures and discipline, as stipulated for ERT communications in the Emergency Response Manual, be strictly adhered to.

9.11 Incident Command - Span of Control

9.11.1 Conclusion

It is concluded that the Incident Commander was not in compliance with the provisions of SOG #18 in that he assigned 8 teams to report initially to him and later to the Sector Officer, which exceeded the stipulated span of control limit of 5.

9.11.2 Recommendation

It is recommended that Incident Commanders, insofar as is practical, avoid exceeding the recognized limit of effective span of control themselves or requiring it of Subordinate Commanders.

9.12 Incident Command - Division of Responsibilities

9.12.1 Conclusion

It is concluded that the Incident Commander was making both strategical and tactical decisions based on very limited information received in Command Post and without benefit of a visit to the incident site and that this was an unsound method of exercising command and control of an incident.

9.12.2 Recommendation

It is recommended that, whenever possible the Incident Commander attend the incident site prior to selecting the strategy to be followed and that in circumstances where this is not possible strategy be selected based on information received from the officer who conducted the size-up. It is further recommended that the Sector Officer, whenever possible with the participation of the Captain who conducted the size-up, decide upon tactics.

9.13 Incident Command - Size-Up

9.13.1 Conclusion

It is concluded that the team assigned to carry out a size-up of the incident, that had elements on elevations 591, 615 and 639 of Unit 8, became distracted and did not complete this important task which, at least initially, serves as the basis for the selection of strategy and tactics. It was further concluded that this led to the Incident Commander taking decisions without adequate information.

9.13.2 Recommendation

It is recommended that the importance of a thorough size-up be stressed in training exercises and that a SOG based on the definition given at Appendix "C" be developed.

9.14 Incident Command - Supervision of Staging Areas

9.14.1 Conclusion

It is concluded that the team assigned to the staging area near Unit 8 on elevation 591 became engaged in fire fighting and rescue operations leaving the staging area without supervision and that this resulted in a lack of control of resources at that point.

9.14.2 Recommendation

It is recommended that a Staging Officer be assigned to each staging area that is established to control movement of personnel and equipment to and from the area to facilitate the effective utilization of all available resources.

9.15 Operations - Fire Fighting and Rescue

9.15.1 Conclusion

It is concluded that the failure to provide fire fighting and rescue services on elevation 615 for an extended period allowed the fire to burn unchecked and an injured person to suffer unduly and to be exposed to life threatening conditions, since the area was said to have low heat and dense smoke. In assessing this matter one needs to be mindful of the fact that this was the location where the fire originated.

9.15.2 Recommendation

It is recommended that on-scene supervision be strengthened and that the conduct of a thorough size-up be recognized as a fundamental requirement in this area.

9.16 Fire Fighting Tactics

9.16.1 Conclusion

It is concluded that oil was the main fuel involved in the fire and that the tactic of fighting the fire with water prior to applying either foam or dry chemical allowed the fire to burn longer than necessary. It was further concluded that although the Bruce "Site" Fire Crew displayed the capability to produce foam, they were not asked to simulate its application.

9.16.2 Recommendation

It is recommended that the use of foam on burning flammable or combustible liquids in circumstances where it can be applied on the surface and that dry chemical be the medium of choice in circumstances where the fuel is running from one level to another.

9.17 Operations - Appointment of a Sector Officer

9.17.1 Conclusion

It is concluded that the long delay in appointing a Sector Officer detracted from effective command and control of the incident.

9.17.2 Recommendation

It is recommended that a Sector Officer be appointed, in keeping with the provisions of SOG #18, as soon as it is known that there is a large incident and that it be recognized that it may be necessary to appoint additional Sector Officers if more than one elevation level is involved.

Appendix A

Ontario Hydro Scenario for the November 22, 1994 Fire Exercise at Bruce B NGS

Note: This Appendix was reproduced from the Ontario Hydro document.

Appendix A

Ontario Hydro Scenario for the
November 22, 1994 Fire Exercise at Bruce B NGS

BRUCE-B CORPORATE FIRE EXERCISE SCENARIO

SCENARIO OVERVIEW

Unit 5 outboard hydrogen seal begins to leak oil (615' elevation). The oil runs down and spreads on the floor on the 591' elevation. This causes a "Generator H2/Seal Oil Differential Pressure Lo" alarm (An 544) to come in at Unit 5 Desk. Leaking hydrogen is ignited and sets fire to the leaking oil.

Sprinklers are activated (below the hydrogen fire level at the seal) and are flowing water. This in turn brings in a Unit 0 alarm "Fire in the Station See Main control PL18A" An2415. The dispatch of the Emergency Response Team will be due to this alarm. (Depending on the speed of response to the unit upset caused by the leak, the unit field operator could also call in the fire). The time delay between the Unit 5 Diff Pressure Alarm and the Unit 0 alarm is 4 minutes. This allows for a larger amount of oil to accumulate on the 591' elevation.

LOCATION OVERVIEW

639' elevation	Smoke rising around the Generator skirt.
615' elevation	Fire below the 639' at the outboard seal of the Generator (hydrogen). Burning, dripping oil flowing down through floor grating, high noise level due to fire, heavy smoke in the area. One casualty around the Exciter area.
591' elevation	Approximately 15'x 25' burning oil spill on the floor, burning, dripping oil cascading from the upper level. Heavy smoke and intense heat has ignited oil in the pit located to the west of the unit under the metal cover. Smoke is visible coming from inside the pit. Cables in a cable tray directly above the pit will be ignited. There are two casualties on this elevation (one of them with serious injuries, requiring hospital treatment).

24 October 1994

BRUCE B CORPORATE FIRE EXERCISE SCENARIO

TIME-LINE

TIME MINS	EVENT
-6	Unit 5 running at 88% power.
	Seal oil leak starts (Seal oil/H2 differential pressure starts to reduce).
-4	"Gen/H2 Diff Press Lo" alarm in Main Control Room (MCR).
-2	Hydrogen ignites, oil fires spread to the 591' elevation, sprinklers activated by the fire (below level of Hydrogen fire, therefore only spread the oil on the 591' elevation, causing puddles).
-1	Unit 0 Alarm "FIRE IN STATION SEE PL18A."
	Oil spill has already spread to the 591' El and fire ensues at this location (15'x 25' oil spill, spread into adjacent pit). Cables in a cable tray directly above the pit also ignite.
0	Fire alarm sounded, response initiated [Shift Supervisor, In Plant Coordinator to Emergency Operations Centre (EOC), Shift Operating Supervisor to Unit, Emergency Response Team (ERT) to ERT Base room, Off-Site Survey Team (OSST), to the incident area].
	Turbine and subsequent reactor trip occur/initiated.
1+	Incident Command established. ERT duties being assigned to teams, teams don fire gear, SCBA, enroute to the scene.

24 October 1994

BRUCE B CORPORATE FIRE EXERCISE SCENARIO

TIME-LINE

TIME MINS	EVENT
5+	EOC staffed and operational, communications established. Site ERT notified to provide assistance. ERT accounting initiated. Notifications (internal and external) initiated.
6+	OSST outside fire incident area (drive fire cart to the scene, conduct radiation surveys enroute, support for the ERT).
8+	Size-up team at the scene. Staging area set-up, communications established.
10+	Primary search underway. Some fire control actions initiated (to assist search and rescue). Bruce NGS-A ERT and Tiverton Fire Dept notified for additional assistance.
15	Bruce B ERT initial deployment complete. Amount of smoke may lead to a station assembly and accounting.
17	Site ERT at Bruce B.
20+	Site ERT deployed to assist BNGS-B ERT. Casualties located, treatment initiated. Kincardine Hospital notified. Casualties being prepared for transport to Kincardine Hospital.

24 October 1994

BRUCE B CORPORATE FIRE EXERCISE SCENARIO

TIME-LINE

TIME MINS	EVENT
	"All Clear" confirmed and communicated.
	Fire control activities initiated (BNGS-B assisted by site ERT).
40+	BNGS-A ERT deployed (relief for BNGS-B, site ERT).
	Tiverton Fire Dept at the station. Secondary search initiated.
	Rehab identified and implemented.
	Fire "Under Control" confirmed and communicated.
60+	Post fire incident activities ie reporting, investigations, fire watch, etc. (Dependent on external organizations participation). - Securing scene - "Loss Stopped" confirmed and communicated. - Completing notifications and reporting - Investigation (Fire Dept, OPP, Labour) - ERT equipment clean-up - Hospital treatment of casualty (potentially contaminated) - Information Centre/Media/Public follow-up
120	Exercise terminated

24 October 1994

BRUCE B CORPORATE FIRE EXERCISE SCENARIO

TIME-LINE

CASUALTIES SCENARIO

Casualty #1 Driving forklift carrying 1 cubic metre containers (just outside the oil fire area, 591' El). Upon hearing hydrogen ignition, tips containers, falls in attempting to get away from the scene. This worker is seriously injured (conscious initially, but becomes unconscious later, head and possible neck injuries, broken femur) and requires hospital treatment.

Note: **When casualty #1 leaves his forklift after the hydrogen ignition, the forklift with propane cylinder and 1 cubic metre containers are right outside the edge of the fire area and warrant some ERT action to prevent a propane tank explosion/fire.**

Casualty #2 591' El, mechanic working on the seal oil package, conscious, in great distress (underneath the H2 ignition, close to the oil fire).

Casualty #3 615' El, electrical contact on left hand and foot, down and dazed, semi-conscious, some cuts and bruises and limited smoke inhalation.

24 October 1994

BRUCE B CORPORATE FIRE EXERCISE SCENARIO

TIME-LINE

CONTROL ROOM SCENARIO

A simulator run of this incident has been completed and panel indications, alarms, etc. are available to use as the control room scenario inputs, evaluate operator actions (simulated, in the control room and the field).

NOTE: **Operator inputs to the turbine and reactor trips will not be simulated and their response to these upsets will not be evaluated.**

MEDIA SCENARIO

Calls from the public or media could result from only scanning of ERT radio-communications during the drill. Smoke is not expected to be visible outside the station (as it may be during a real event).

615' ELEVATION

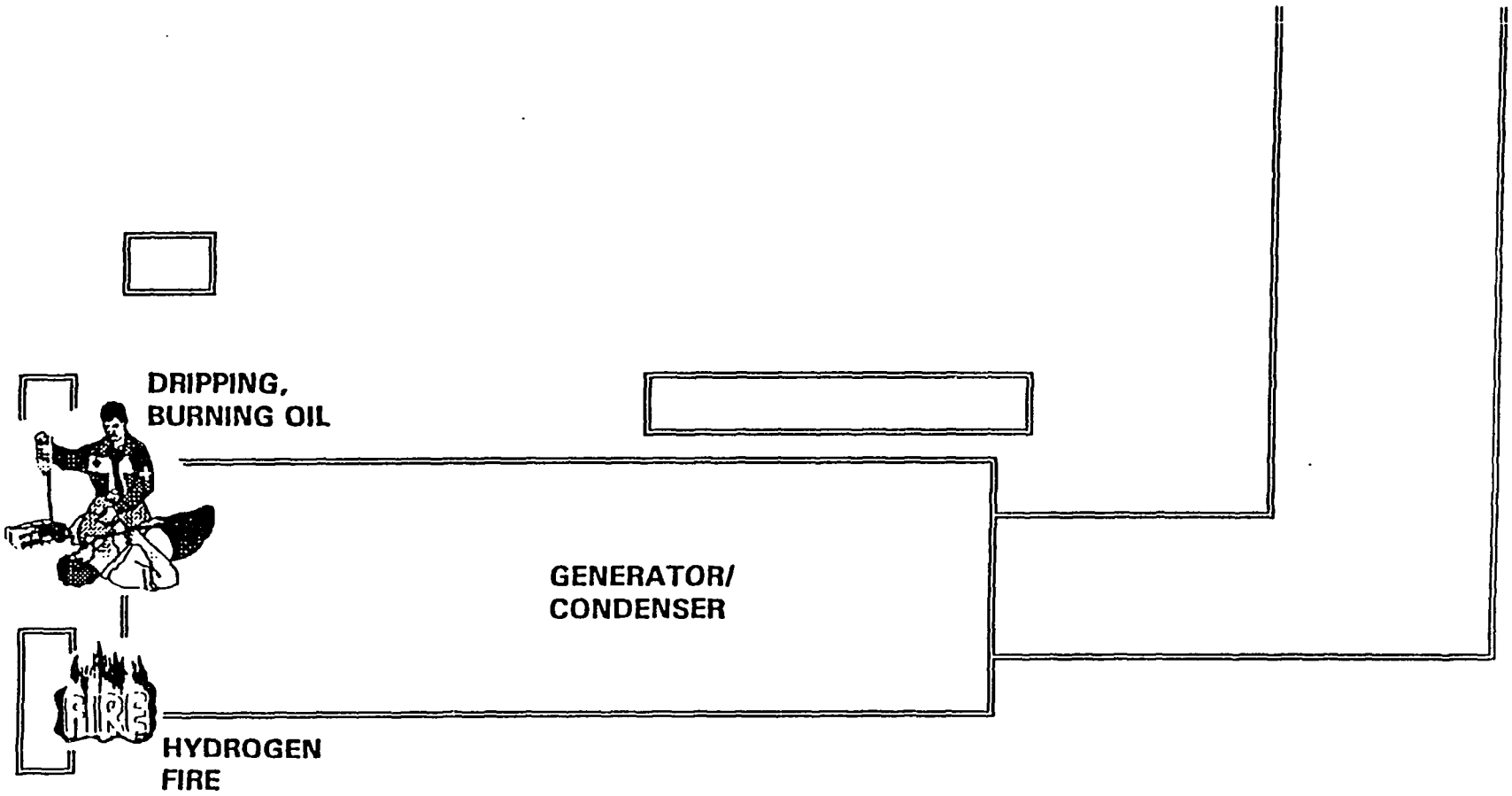


FIG 1

591' ELEVATION

RADIOACTIVE WASTE HANDLING

CABLE FIRE(S)

CONDENSER

STATOR COOLING SYSTEM

SEAL OIL SYSTEM

HYDROGEN ADDITION STATION

FIG 2

Appendix B

Definition of a "Large Fire" and Basic Requirements Evaluation Exercise

Definition of a "Large Fire"

For the purposes of exercises and evaluations at NGS a "Large Fire" may be described as follows.
"A fire involving sufficient combustible and/or flammable material so as to over-tax the initial response force. It should have the potential to extend to fuel not involved initially, pose a threat to personnel, cause casualties and be of sufficient severity to require the assistance of off-site fire fighting resources including, where appropriate, alerting members of any mutual aid plan that is in place in the area. In addition, it should require the notification of key persons in the Ontario Hydro and AECB organizations and such others as may have similar need to know and to act".

This definition was agreed to by Ontario Hydro during the period that the scenario was being developed.

Basic Requirements - Evaluation Exercise

The basic requirements of an exercise to evaluate the capability to deal effectively with a serious incident is as follows.
"An evaluation exercise must include components that address the ramifications of all facets contained in the definition of a "Large Fire".

Appendix C

A Review of Bruce B NGS Fire Plans

• REVIEW REPORT •

BRUCE B NUCLEAR GENERATING STATION

EMERGENCY RESPONSE MANUAL

• *FIRE CROSS CONSULTANTS INC.* •

A Review of Bruce B NGS Fire Plans

TABLE OF CONTENTS

Introduction

The aim of the review was to evaluate the scope and clarity of Bruce B NGS fire plans and to assess the suitability of the strategy selected as the basis for fire fighting and rescue operations and in the event that modifications were found to be necessary, to make appropriate recommendations to AECB.

The work involved a study of a document titled "Emergency Response Manual". The manual contained two sections on fire procedures, one titled "Action Guides and the other "Reference Section". A third section titled "ERT Communications" also had direct application on fire crew emergency procedures. Those sections of the manual dealing with other subject areas were not studied. The manual had something in the order of 250 pages to 300 pages. In addition, a cross section of the some 400 pages to 500 pages of information sheets on specifically defined areas of the plant were assessed.

As the study progressed it became evident that it would be necessary to extract the information contained in the flow charts and to reformat it along the lines of a position analysis of each position or group that was charted. This was done in order to assess the distribution of responsibilities and to more readily identify matters requiring further attention. The study showed that there was little direct relationship between the Reference Section which was largely administrative in nature and the Action Guides Section which dealt mainly with operations. Accordingly, it was found that the most logical approach was to address policy and administration separate from emergency operations.

Overview

The title of the sections of the document that were studied in some detail, clearly indicated that its purpose was to describe procedures to be used in the conduct of fire fighting and rescue emergency operations. The introductory paragraph to the reference section however made it equally clear that the contents were almost exclusively devoted to fire protection policy on administrative matters and on technical matters regarding human resources and material resources for fire protection. Although this section contained some elements of a fire safety plan, as such is defined in both the National Fire Code of Canada and the Ontario Fire Code, as the study progressed it appeared evident that it was not intended to be nor could it be construed to be such a plan. If, as believed, this was so, a fire safety plan was not provided for review.

The action guides section consisted, in the main, of a series of flow charts depicting the step by step actions required of designated persons or groups during fire related emergencies. The flow charts are more or less check lists arranged in a graphic format. There was however no policy that addressed fire fighting and rescue operations. This was a serious void and caused the treatment of this activity in the flow charts to be somewhat superficial in nature. Conversely the section on communications was found to be a well structured document.

In order to view the matter from a practical perspective it is useful to look at the role operations policy should play in relationship to fire fighting and rescue services. This done, it can be held that two features or purposes take on primary importance. These may be described as having the scope and clarity to: serve as the foundation for strategy, tactics and the associated standard operating procedures; and to educate all who bear responsibility for implementing or complying with such policy.

To summarize, even though the manual reflected a great deal of effort related to its preparation and good attention to safety from fire, there was very little in the text to indicate the level of preparation for dealing with a "large fire". To take this a step further, as operations were outlined in the flow charts section, there was also a number of important discrepancies. The most critical being a number of oversights, most particularly: strategy and tactics; and command and control. In any case, flow charts/check lists are obviously not a suitable medium for promulgating policy. The manual contained very little of substance in these areas that are of pivotal importance to fire fighting and rescue emergency operations.

It is also of importance to recognize that well considered and clearly described strategy and tactics serve as the basis for the development of standard operating procedures as well as being a key to effective spontaneous decision making under emergency circumstances. As such, policy in these areas affects the effective exercise of command and control of an emergency incident. Its importance should, therefore, be measured in this context. Further to this, where command and control is concerned, there were also conflicting statements in the manual. Specifically, in text section the Shift Emergency Response Coordinator (SERC) was stated to -"Be the Field Resource Coordinator during an actual emergency", while in the flow charts it was stated that "The SERC will act as Incident Commander during an emergency ". Along the same lines, although it was not clear why the Shift Superintendent (SS) would not communicate directly with the IC, the flow charts indicated that the SS "Notify the Incident Commander via the In Plant Coordinator (IPC) of relevant, known system upsets. e.g. seal oil level, hydrogen pressure".

Definitions - General

The Emergency Response Manual contained a number of terms that warranted specific definitions. This was required in order to ensure they impart the same meaning to all concerned. In support of this a definition for each term identified during the review has been included in this report. In addition, a definition for each of a number of terms that, although not used in the Emergency Response Manual are appropriate for such purpose has also been included. This was done as a means of providing assistance in this area.

All definitions included in this report are for the purposes of this report only until such time as they may be included in a fire fighting and rescue emergency operations manual. It is also intended that the definitions serve as a guide regarding the type of material that should be addressed in the process of developing operations policy.

Definitions - Phases of Fire

Incipient Phase of Fire

The *incipient phase* is the earliest phase of a fire beginning with the actual ignition. The fire is limited to the original materials of ignition. In the incipient phase, the oxygen content of the air has not been significantly reduced, and the fire is producing water vapour (H_2O), carbon dioxide (CO_2), perhaps a small quantity of sulphur dioxide (SO_2), carbon monoxide (CO), and other gases. Some heat is being generated, and the amount will increase as the fire progresses. The fire may be producing a flame temperature well above 537° C (1000° F), yet the temperature in the room at this stage may only be slightly increased. (IFSTA Essentials)

Steady State Burning Phase of Fire

The *steady-state burning phase* (sometimes referred to as the free-burning phase), for the purposes of simplicity, can generally be considered the phase of the fire where sufficient oxygen and fuel are available for fire growth and open burning to a point where total involvement is possible. During the early portions of this phase, oxygen-rich air is drawn into the flame, as convection (the rise of heated gases) carries the heat to the uppermost regions of the confined area. The heated gases spread out laterally from the top downward, forcing the cooler air to seek lower levels, and eventually igniting all combustible materials in the upper levels of the room. This early portion of the steady-state burning phase is often called the flame spread phase. The presence of heated air is one of the reasons fire fighters are taught to keep low and to wear protective breathing equipment. At this point, the temperature in the upper regions can exceed 700°C (1300°F). One breath of this superheated air can sear the lungs.

Thermal columns will normally occur with rapid air movements upward from the base of the fire. As the fire progresses (in a confined space) through the latter portions of the steady-state burning phase, the fire continues to consume oxygen until it reaches the point where there is insufficient oxygen to react with the fuel. The fire is then reduced to the smoldering phase, but this fire needs only a fresh supply of oxygen to burn rapidly. (IFSTA Essentials)

Hot-Smoldering Phase of Fire

The *hot-smoldering phase* can occur when, after the steady-state burning phase, flames may cease to exist if the area of confinement is sufficiently air tight. In this instance, burning is reduced to glowing embers. As the flames die down, the room becomes completely filled with dense smoke and gases. Air pressure from gases being given off may build to the extent that smoke and gases are forced through small cracks. Room temperatures in excess of 537°C (1000°F) are possible. The intense heat will have liberated the lighter fuel fractions, such as methane, from the combustible material in the room. These fuel gases will be added to those produced by the fire and will further increase the hazard to the fire fighter and create the possibility of a backdraft if air is improperly introduced into the room. If air is not introduced into the room during the hot-smoldering phase, the fire will eventually burn out, leaving totally incinerated contents. (IFSTA Essentials)

Backdraft

Backdraft can be the most hazardous condition a firefighter will ever face. In the hot-smoldering phase of a fire, burning is incomplete because of insufficient oxygen to sustain the fire. However, the heat from the steady-state burning phase remains, and the unburned carbon particles and other flammable products of combustion are available for instantaneous combustion when more oxygen is supplied. Improper ventilation, such as opening a door or breaking a window, supplies the dangerous missing link - oxygen. As soon as the needed oxygen rushes in, the stalled combustion resumes; it can be devastating in its speed, truly qualifying as an explosion.

The following characteristics may indicate the potential for a backdraft to occur:

- Pressurized smoke exiting small openings
- Black smoke becoming dense grey yellow
- Little or no visible flame
- Smoke leaving the building in puffs or at intervals
- Smoke-stained windows
- Muffled sounds
- Sudden rapid movement of air inward when opening is made

This situation can be made less dangerous by proper ventilation. If the room or building is opened at the highest point involved, the heated smoke and gases will be released, reducing the possibility of an explosion. (IFSTA Essentials)

Rollover

Rollover, sometimes referred to as flameover, takes place when unburned gases released during the incipient phase or early steady-state phase accumulate at the ceiling level. These superheated gases are pushed, under pressure, away from the fire area and into uninvolved areas where they mix with oxygen. When their flammable range is reached, they ignite and a fire front develops, expanding very rapidly and rolling over the ceiling. Rollover differs from flashover in that only the gases are burning and not the contents of the room. The rollover will cease when the main body of the fire is extinguished or reduced in intensity to the point where it does not produce sufficient flammable gases to feed the rollover. (IFSTA Essentials)

Flashover

Flashover occurs when flames flash over the entire surface of a room or area. The actual cause of flashover is attributed to the build-up of heat from the fire itself. As the fire continues to burn, all the contents of the fire area are gradually heated to their ignition

temperatures. When they reach their ignition point, simultaneous ignition occurs, and the area becomes fully involved in fire. The actual ignition is almost instantaneous and can be quite dramatic. A flashover can usually be avoided by directing water toward the ceiling level and the room contents to cool the materials below their ignition temperatures. (IFSTA Essentials)

Definitions - Miscellaneous Fire Terms

Large Fire
A *large fire* may be described as a fire involving sufficient combustible and/or flammable material so as to over-tax the initial response force. It has the potential to extend to fuel not involved initially, pose a threat to personnel, cause casualties and be of sufficient severity to require the assistance of off-site fire fighting resources including, where appropriate, alerting members of any mutual aid plan that is in place in the area. In addition, it requires the notification of key persons in the Ontario Hydro and AECB organizations and such others as may have similar need to know and to act. (Ref- Fire Cross)

Working Fire
A *working fire* is any fire that cannot be extinguished by the occupants using portable fire extinguishers and therefore requires intervention by a fire department or other organized fire fighting force. (Ref- Fire Cross)

Exposure Fires
An *exposure Fire* is any blaze that has extended from it place of origin either to another building or to an independent unit of the same building; the former being known as external exposure and the latter, internal exposure.
(Ref - Fire Chief's Handbook, Third Edition)

Definitions - Plans, Objectives and Methods

Strategic Plan
A *strategic plan* identifies the broad goals of emergency fire fighting and rescue emergency activities and the basic manner in which the operations shall be conducted. Such plans may be based on either offensive strategy or defensive strategy. (Ref- NFPA 1561)

Defensive Strategic Plan
A *defensive strategic plan* involves operations directed toward protecting exposures.
(Ref- NFPA 1561)

Offensive Strategic Plan
An *offensive strategic plan* involves operations to provide search and rescue, and to control and extinguish the fire. (Ref- NFPA 1561)

Tactical Objectives
Tactical objectives are activities undertaken to facilitate execution of the *strategic plan. Tactical objectives* should be based on the strategic plan and are generally assigned to *Supervisors* by the *Incident Commander.* (Ref- NFPA 1561)

Size-Up
By *Size-Up* is meant the making of a survey of the situation encountered by fire fighting forces on arrival at the scene of the fire. It includes life hazard as well as hazard to property, and all factors that have a bearing thereon. Typical factors that require attention during *Size-Up* includes: time of day, weather, location of the fire; threat to plant safety systems; life hazard; installed fire suppression systems; type of fuel involved or likely to become involved; presence of hazardous materials; fire exposures and life exposures and requirements for additional help.
(Ref - The Fire Chief's Handbook, Third Edition/Fire Cross)

Primary Search
Primary search is the search of the incident scene for persons that is conducted as soon as resources are available in the early stages of fire fighting and rescue operations and that is subject to the restrictions imposed by hostile conditions. (Ref- Fire Cross)

Secondary Search
Secondary search is the search of an incident scene for persons that is conducted after hostile conditions have either been eliminated or reduced in severity to such a degree that they do not impose any restrictions on the thoroughness of the search. (Ref- Fire Cross)

Direct Attack
Direct attack is the direct application of water on the burning fuels at the base of the fire until the fire "darkens down". (Ref- IFSTA Essentials)

Indirect Attack
Indirect attack is a procedure whereby fire streams are directed at the ceiling and played back and forth in the superheated gases at the ceiling level. It is used in circumstances where fire conditions are so severe as to prevent entry for a *direct attack* and continued until such time as a *direct attack* is possible. (Ref- IFSTA Essentials)

Combination Attack
The *combination method* uses the steam-generating technique of the ceiling level *indirect attack* combined with a *direct attack* on materials burning near the floor level. (Ref- IFSTA Essentials)

Ventilation
Ventilation of a fire scene refers to the systematic removal of heated air, smoke and gases from a structure and the replacement of these materials with cooler air. (Ref- IFSTA Essentials)

Definitions - Incident Site & Operations Support

Incident Scene
The *incident scene* is the location where activities related to a specific incident are conducted. This includes the entire area subject to incident related hazards and all areas used by fire crew members and equipment in proximity to the *incident scene.* (NFPA 1561)

Resources
Resources are the personnel and equipment that are utilized or are available to be utilized at the scene of an incident. (Ref- NFPA 1561)

Staging
Staging is the assembly of resources in an area close to the area where the need for those resources is anticipated. (Ref- NFPA 1561)

Definitions - Command and Control

Incident Commander
The *Incident Commander* is the fire service member in overall command of an emergency incident. (Ref- NFPA 1561)

Supervisor
A *Supervisor* is a fire crew member who has supervisory authority and responsibilities over others. (Ref- NFPA 1561)

Span of Control
Span of Control is a function of a supervisor to monitor the activities of subordinates and to communicate with them. (Ref - NFPA 1561)

Policy and Administration

The text section of the manual addresses matters relating to fire safety quite effectively. In matters relating specifically to the fire crews, assignment of responsibility seemed to be excessively decentralized. In this regard the Shift Superintendent, the In-Plant Coordinator, the Safety Superintendent, the Emergency Preparedness Coordinator and the Temporary Emergency Preparedness Officer/Shift Emergency Response Coordinator all had administrative roles to play. To further complicate the issue, the latter position was designated to serve as Field Resource Coordinator during an emergency rather than Incident Commander.

In looking at this area it appeared logical that the position or positions involved with the fire crews should be responsible to the Shift Superintendent. From this point on the situation was less clear. Nevertheless, a study of the flow charts showed that the In-Plant Coordinator had the most important support functions to perform during emergency operations. From this, some logic emerged that would have this position more or less solely responsible for the management of the Emergency Response Teams, with the Shift Emergency Response Coordinator being fully integrated into the Emergency Response Teams as a member to serve in the role of Incident Commander.

Organizational Structure - Emergency Operations

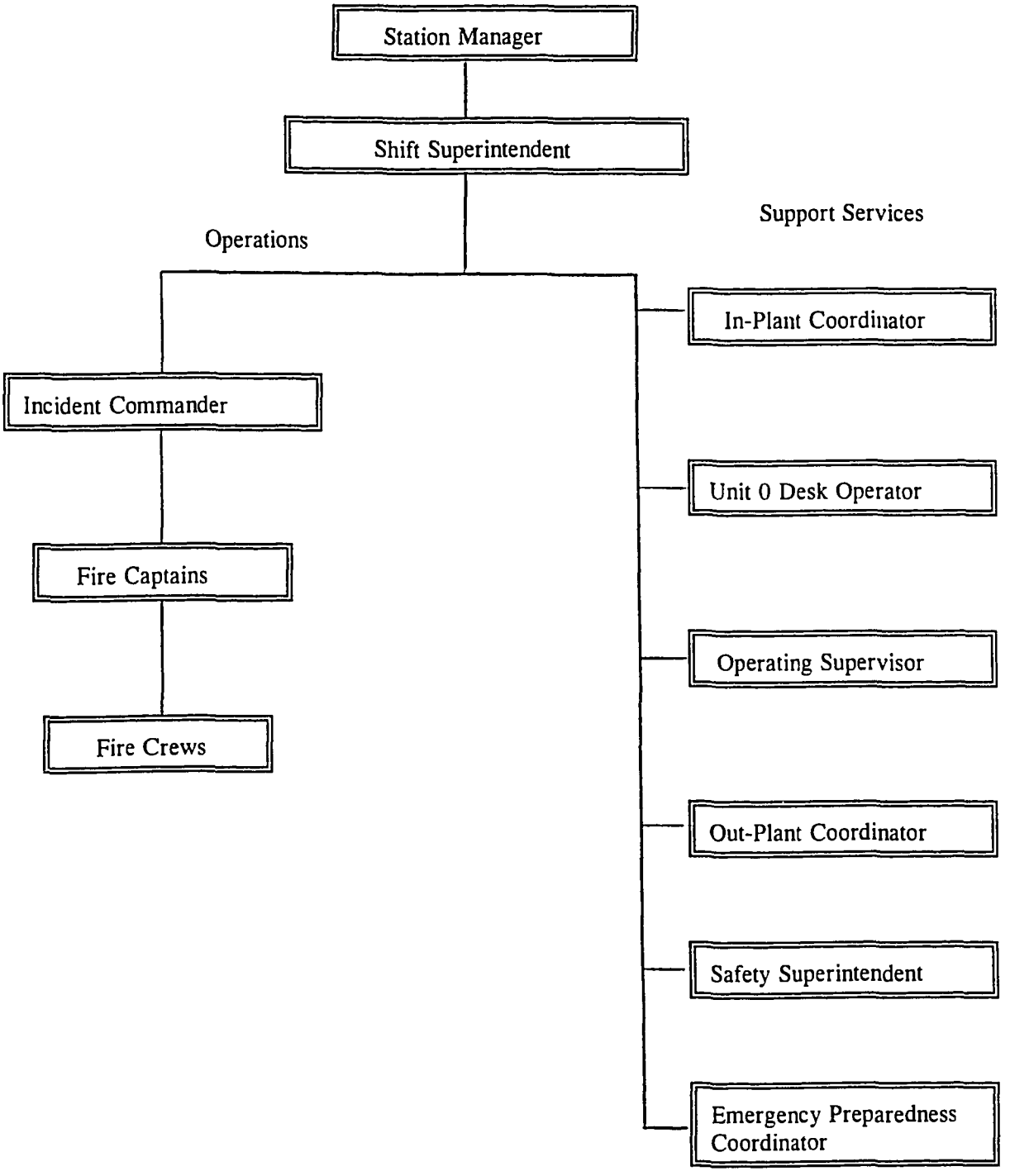
Where policy and procedures for emergency operations were concerned, with few exceptions, the only source of information was the flow charts. Such charts can be a useful tool to track the direction a given set of policies would lead, they are, however, an inappropriate means for stating or describing policy. To overcome this shortcoming to at least a limited degree for the purposes of this study, the tedious process of extracting information from the charts was undertaken and a listing of responsibilities for each designated person or group compiled. Responsibilities of importance that were not included in the flow charts and that were inserted by *Fire Cross* to illustrate oversights, have been identified by an asterisk. Further, to set up a convenient format, an interpretive statement was inserted as a form of introduction for each position.

The results of this process are shown on subsequent pages. The key benefits from this were that it yielded a profile of whom was responsible for what and allowed for the identification of oversights and/or errors. As well, based on our interpretation of the flow charts, Figure 1 was developed to illustrate the organization that would be in effect during a fire related emergency. This figure does not include resources external to BNGS B.

Figure 1

ORGANIZATIONAL STRUCTURE

BRUCE B NGS FIRE FIGHTING AND RESCUE OPERATIONS



Shift Superintendent (SS)

The Shift Superintendent of each shift directs fire fighting and rescue services and supervises fire incident response by:

a. reporting to the Emergency Operating Centre (EOC) on indication of fire;

b. analyzing fire situation information received from the In Plant Coordinator (IPC), Shift Operating Supervisor (SOS), and the Unit Operator;

c. notifying the IC of relevant, known systems upsets; (e.g. seal oil level, hydrogen pressure and the like)

d. noting when the ERT has assembled and notifying the Unit 0 Desk Operator (UZDO);

e. monitoring the progress of fire fighting and rescue operations to determine if adequate resources are available;

f. ensuring additional resources are notified if required;

g. assessing the danger to station staff from fire, radiological, toxic or other hazards;

h. directing the UZDO to make an appropriate public address announcement regarding evacuation, assembly and accounting if such is required;

i. notifying the NISSS if the conditions require;

j. on being informed that the emergency is terminated, direct the UZDO to make a public address announcement that all personnel not involved in emergency action return to normal duties;

k. instructing the Incident Commander (IC) to secure the incident area for investigation purposes as conditions dictate;

l. when appropriate, informing the Non-Incident Shift Supervisor (NISSS) that the emergency is terminated;

m. informing the UZDO that the emergency is terminated; and

n. filing a fire report.

Shift Emergency Response Coordinator (SERC)
The Shift Emergency Response Coordinator of each shift, in the role of Incident Commander, exercises command and control of fire fighting and rescue operations by:

a. reporting to the Command Post (CP) on the sounding of the fire siren;

b.* exercising overall command and control of emergency operations;

c. dispatching a size-up team to the incident;

d. assigning a person as Scribe and Desk Radio Operator;

e. donning the "Incident Commander" identification vest;

f. dispatching a fire attack team and a first aid team to the incident;

g. assessing information on the incident as provided by the size-up team;

h. ensuring that Emergency Response Team (ERT) member accounting is complete and advise EOC;

i. reviewing the fire response information sheet(s) for the incident area;

j.* doing a size-up of the incident, at the incident scene, as soon as practicable;

k.* for small incidents, determining strategy and tactics and assigning tasks to Field Captains;

l.* for large incidents, determining strategy and providing direction to Sector Officer (s)/ On Scene Supervisors (OSS);

m. establishing a level 1 and level 2 staging area and informing all concerned of the locations via a PA announcement;

n. reassessing the location of the CP and if it is advantageous to relocate, inform IPC and ERT;

o. informing the IPC of any information on a casualty or casualties that has been received by telephone or messenger;

* Inserted by *Fire Cross*.

p. taking the following actions if the fire is in a radiological area,
i. request Radiation Protection Assistants or, alternatively, assign ERT members to ensure full radiation hazards are determined initially and every 15 minutes thereafter, and by requesting contamination control barriers be established;

q. informing ERT and EOC when an "All Clear" is received regarding all primary search areas;

r. deploying Site ERT as required when available;

s. providing IPC and Nuclear Waste and Environmental Services Division (NWESD) SERC with situation reports as significant information becomes available;

t. taking the following actions when additional resources are required,
   i. request IPC to activate ERT/Bruce County Mutual Fire Aid Association (BCMFAA),
   ii. request personnel for traffic control, reactor safety concerns, electrical isolation, ventilation, spill clean-up, etc., and
   iii. deploy ERT resources as required;

u. taking the following actions when "FIRE UNDER CONTROL" has been declared,
   i. inform the EOC and all ERT members,
   ii. assign salvage teams to reduce loss, and
   iii. assign a team to conduct overhaul;

v. taking the following actions when "LOSS STOPPED" ("FIRE OUT") has been declared,
   i. inform the EOC and all ERT members,
   ii. assign a team to conduct a secondary search,
   iii. obtain any casualty related information by telephone or messenger, (do not use radio), and
   iv. inform the IPC and request any assistance that may be necessary;

w. taking the following actions when an "ALL CLEAR" has been declared on the secondary search,
   i. inform the EOC and all ERT members,
   ii. if required, assign personnel to conduct contamination surveys of the area and equipment,
   iii. if required, arrange for decontamination as dictated by circumstances,
   vi. arrange for the incident area to be secured for investigation purposes,
   v. ensure all persons perform a personal dose evaluation,
   vi. inform the SS immediately of any dose or contamination problems, and
   vii. assign personnel to check equipment used and to return it to a ready state;

x. informing the IPC that equipment is in ready state;

y. requesting the SS to sound the "ALL CLEAR EMERGENCY TONE" ; and

z. forwarding the emergency log to the SS.

Emergency Response Team Captain (s) (ERT Cap)
The Emergency Response Team Captain (s) of each shift supervise the on-scene delivery of fire fighting and rescue services by:

a. reporting to room S227 on the sounding of the fire siren;

b. setting up the ERT accounting process ;

c. donning protective clothing, including Self Contained Breathing Apparatus (SCBA) with the face piece slung over the neck until needed;

d. the first Captain to arrive at room S227 with 2 ERT members, all completely outfitted, deploy to the incident site as the Initial Size-up Team;

e. by having the second Captain to arrive at room S227 act as IC until relieved by the SERC or delegate;

f. by having the third Captain to arrive at room S227 take up to 4 ERT members and deploy as a fire attack team;

g.* directing ERT members in the performance of rescue and fire fighting activities;

h. providing situation reports to the IC on any significant change in conditions at the incident;

i.* supervising overhaul and fire watch activities; and

j. supervising the conditioning of equipment in the process of returning same to the ready state; and

k.* the first Captain at the incident serving as On Scene Supervisor (OSS)/Sector Officer under the direction of the IC.

* Inserted by *Fire Cross.*

Emergency Response Teams (ERT)

The Emergency Response Team(s) of each shift are at the forefront in the delivery of fire fighting and rescue services by:

a. reporting to room S227 on the sounding of the fire siren;

b.* donning protective clothing, including SCBA with the breathing regulator disconnected from the face piece until needed;

c. performing fire fighting and rescue operations;

d. providing first aid to the injured;

e. performing overhaul and fire watch procedures; and

f. conditioning equipment used in fire fighting and rescue operations in the process of returning same to the ready state.

In Plant Coordinator (IPC)

The In Plant Coordinator of each shift provides support to the Shift Superintendent during emergency operations by the fire fighting and rescue services by:

a. reporting to the EOC;

b. phoning the UZDO to obtain all reported details of the fire and record the information in a log;

c. obtaining a scribe to maintain a log of emergency related information;

d. phoning Site ERT;

e. having UZDO make a public address announcement directing all non-duty ERT members on "supers" or overtime to report to S226;

f. requesting OPC to have OSST escort at the South Guardhouse;

g. informing the Non-Incident Station of the incident by telephone;

h. assigning a person to monitor the I/P emergency radio channel and by reporting all significant items to the SS;

* Inserted by *Fire Cross.*

i. establishing radio communications with the IC, call sign BRAVO COMMAND;

j. ensuring, through the IC, that all ERT members are accounted for;

k. notifying the SS when the ERT are assembled;

l. informing the SS of notable changes to the incident status;

m. informing Security by phone if Site ERT are coming;

n. ensuring radiation surveys are performed if the fire is in a radiation area;

o. actioning IC requests for back-up resources to be placed on standby by,
   i. requesting Bruce A to place ERT on standby,
   ii. requesting BCMFAA, through Tiverton and District Fire Department (T&DFD) telephone 8-9-368-7100, to go on standby, and by
   iii. informing the SS at the request for backup resources to go on standby;

p. actioning IC requests for backup resources to respond by,
   i. requesting Bruce A to respond,
   ii. requesting BCMFAA to respond,
   iii. informing the SS and Security that backup resources will be responding,
   iv. arranging for "Green Manning" to escort incoming responders, and by
   v. requesting the Out of Plant Coordinator (OPC) to have Off-Site Survey Team (OSST) escort at the Guardhouse;

q. actioning direction from the SS regarding requirement for assembly or evacuation; and

r. informing the SS, the Non-Incident Station (NIS) IPC, Security and backup responders when the emergency is terminated.

Unit Zero Desk Operator (UZDO)

The Unit Zero Desk Operator of each shift provides support to the Shift Superintendent during emergency operations by the fire fighting and rescue services by:

a. receiving and logging information pertinent to fire fighting and rescue emergency operations;

b. checking the fire alarm panel in the Control Equipment Room (CER) to determine and then record the location of the incident, taking care not to reset the alarm panel until the incident is concluded;

c. immediately sounding the siren and by making the appropriate announcement on the public address system;

d. immediately following c. above, repeating the sounding of the fire siren, twice repeating the public address announcement, and subsequently by repeating this announcement at 5 minute intervals until advised by the SS that emergency crews have assembled and, following that, at 15 minute intervals until the incident is terminated;

e. making other announcements as directed;

f. sounding the emergency tone if evacuation is required, followed by an appropriate public address announcement; and

g. sounding the "All Clear" when so directed followed by an appropriate public address announcement.

Shift Operating Supervisor (SOS)

The Shift Operating Supervisor of each shift provides support to the Shift Superintendent during emergency operations by the fire fighting and rescue services by:

a. obtaining information from the UZDO or the Unit Authorized Nuclear Operator (UANO);

b. proceeding to the incident Main Control Room 2 (MCR) desk;

c. phoning the IPC for an update as needed;

d. taking the following actions if the unit operation is or may be affected by fire,
   i. proceeding to, or dispatching SOS delegate (non-incident Unit ANO, SNO or SSIT) to Command Post, there to report to the IC to determine affected equipment,
   ii. assessing known or potential reactor safety concerns from MCR,
   iii. taking steps necessary to resolve reactor safety concerns, and by
   iv. informing the SS of the steps taken to eliminate/minimize reactor safety concerns.

Shift Safety Superintendent (SSS)[1]

The Shift Safety Superintendent provides support to the Shift Superintendent during emergency operations by the fire fighting and rescue services by:

a. serving as a resource for the SS.

Emergency Preparedness Coordinator (EPC)[1]

The Emergency Preparedness Coordinator of each shift provides support to the Shift Superintendent during emergency operations by the fire fighting and rescue services by:

a. serving as a resource for the SS.

Out of Plant Coordinator (OPC)

The Out of Plant Coordinator of each shift provides support to the Shift Superintendent during emergency operations by the fire fighting and rescue services by:

a. following the sounding of the fire siren, listening to the public address announcement;

b. reporting to the EOC;

c. obtaining information from the IPC and/or the SS;

d. informing the OSST Captain of the designated staging area; (Note that the initial staging area is to be on the elevation of the fire at the elevator between the fire and room S227.)

---

[1] The position is addressed in the text of the Emergency Response Manual but not in the flow charts.

e. verifying with OSST Captain that one member has been dispatched for a fire cart;

f. informing the OSST Captain of the need for escort and designated entry point and route in station; and

g. following Radiation Protection Procedures if the SS decides that OSST is needed off-site.

Appendix D

External Fire Fighting Resources

General

The boundaries of the Bruce Nuclear Generating Station (BNGS) fall within the fire district served by the Tiverton Fire Department. Fire fighting resources external to BNGS were therefore available in the event that outside assistance is required which is worthy of note.

Tiverton Fire Department

The Tiverton fire station was located in the town of Tiverton, approximately 9 kilometres from BNGS via good road access. The fire station houses the following vehicles:

a. one 840 gallon per minute pumper;
b. one rescue van;
c. one tanker with a 1500 gallon water tank; and
d. one mini pumper fitted with two 250 gallon per minute pumps.

The Tiverton fire department had a personnel compliment of a Fire Chief and twenty-two volunteer fire fighters. Inasmuch as the fire station was not manned on a regular basis, the response capability to an incident at BNGS was said to be varied depending upon the time of day. The number of personnel available to respond and the time required to marshal resources was contingent on this factor. The potential of the Tiverton fire department to provide support must be considered in this light.

Communications

The communications system used to receive and process fire alarm calls to the Tiverton fire department was through an answering service based in Port Elgin. The answering service then activated individual pagers of the volunteer fire fighters and the fire station. This method appeared to be the most appropriate for the circumstances as there was no 24 hour manning of emergency telephones by the fire department.

Radio communications used in fire fighting operations was by a "base" radio in the fire station, by radios on all fire vehicles and by portable radios carried by fire fighting crews. The main operating frequency of the Tiverton fire department was the county frequency of 153.86 megahertz (MHZ). In addition an Ontario Fire Marshal frequency of 154.070 MHZ was available.

In the event that the Tiverton fire department responds to an incident at BNGS they are assigned an escort who relays radio information via the BNGS frequencies and they may be loaned a portable radio while on site. This is the only radio link between Tiverton and BNGS as their frequencies are not compatible.

Training

The Tiverton fire department conducted training programs on a bi-weekly basis. Individual members attend regional training programs on occasion and some attend qualification level training programs at the Ontario Fire College at Gravenhurst, Ontario. Ontario Hydro had an excellent training facility at the Bruce site and the Tiverton and area fire departments are invited to participate in cross training programs to enhance their knowledge and skills. This has developed a positive attitude between the participants and Ontario Hydro. All concerned, particularly Ontario Hydro, were deserving of commendation for this initiative.

Bruce County Mutual Fire Aid Association

The Bruce County Mutual Fire Aid Association (BCMFAA) involves formal agreements between eighteen fire departments, including Tiverton, established under the guidelines of the Ontario Fire Marshal's Office. The Fire Chief Of Kinkardine was serving as the coordinator for the BCMFAA at the time of the evaluation. Requests for assistance may be made by any of the participating fire departments.