

PROTECTING FRONT-LINE SURVEY AND RESCUE TEAMS DURING EMERGENCIES

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Teams trained in First-Aid, Fire Fighting and Rescue are available from the shift personnel at British civil nuclear power stations to provide assistance during an emergency. Before the Emergency Controller can deploy these resources safely, he needs information about the situation on the plant. A reconnaissance team with monitoring instruments, protective clothing and self-contained breathing apparatus may first have to enter the accident zone before successful remedial action can be planned. Procedures are described which try to ensure the safety of personnel who have to approach unknown dangers.

The hazards which the reconnaissance team may encounter include:

1. Fire or high temperatures
2. Smoke or poor visibility
3. Concentrations of irrespirable gas (CO₂ at Magnox power stations)
4. Unsafe access routes due to building of plant damage
5. High levels of radiation or contamination.

In most of these accident situations the team may need to wear breathing apparatus, so the personnel involved must train regularly.

TEAM COMPOSITION

The minimum number for a team is 5 trained men, each equipped with breathing apparatus. One member should be a plant engineer with detailed knowledge of the conventional hazards of the site; a second should be used to making radiological measurements; a third should be trained in first aid.

In addition to breathing apparatus, protective helmet, ear defenders and a personal dosimetry pack, the team have found it advisable to take a radiation dose-rate meter, a gas detector, a walkie-talkie radio or jack-in telephone, first aid kit, torches, master keys, a guide line and a B.A. Control Board with clock and pen.

SELECTING THE INCIDENT CONTROL POINT

The Team Leader must use considerable discretion in approaching the unknown situation. When the accident has been located, the team establish an Incident Control Point in a safe place near to the boundary of the hazardous area, taking account of any foreseeable short-term changes. Areas in the reactor buildings with easy access to stairs or lifts and equipped with telephones have been selected as potential control points. The Emergency Controller is informed of the situation and can send forward reinforcements together with a mobile trolley described later.

If the situation demands more than one access route to the area, a separate Incident Control Point is set up at each entry.

If the Control Point becomes untenable, teams already in the

hazardous area are withdrawn at once. When all are out, the Control Point can be resited at a safe location in clean air.

INCIDENT CONTROL POINT PROCEDURES

A trained man is nominated by the Team Leader to take charge of entry procedures. It helps if he puts on a distinguishing armband or helmet. He is referred to as the Control Officer and all personnel who enter the hazardous area must report to him first.

No man is allowed to enter or remain alone in an area of hazard and normally men work in teams of 2 to 4. The opportunity to save life may motivate a man to go beyond these procedures, but he should recognise the risk involved both to himself and to his colleagues.

Usually two men go forward to investigate the situation while two more are immediately available to help if required. A U.H.F. walkie-talkie radio is carried by one member of each team and a "talk through" facility at the Control Point enables the Emergency Controller and other teams to know what information is available.

If self-contained breathing apparatus is required, the tally from each set in use is marked with the wearer's name, the air cylinder pressure and the time of entry to the hazardous area. This tally is pushed into a slot in a Control Board faced with transparent plastic, so that the information cannot be obliterated inadvertently. Men are instructed to return at once to the Control Point if the warning whistle on the B.A. set sounds, indicating 10 minutes air reserve left. The safe working time is entered on the Control Board next to the tally, using initially a standard table and the clock provided. It can be updated if the team members can inform the Control Officer of the reading on the pressure gauges of their air cylinders, because the duration is very dependent on the physical exertion required. The destination or function may also be written next to the tallies. The Control Officer will arrange for each team to be replaced by fresh men at the appropriate time, until the task is completed.

On returning to the Control Point, each B.A. set wearer collects his tally and replaces it on the set when the air cylinder has been changed. If the team do not reappear within the expected time, the Control Officer will send in the reserve pair to locate and assist those missing. In addition, he will ask the Emergency Controller for another pair of men to be available to him before the reserve team are due out, in case further reinforcements are needed.

The Control Officer can cope with 10 to 12 B.A. set wearers at one time. If more need to enter simultaneously, a second Control Point should be considered.

The written record of personnel entries reduces the risk to those in a hazardous area because their safety does not depend on the memory of a man who could himself become a casualty.

USE OF GUIDE LINES

Guide lines are used at the discretion of the Team Leader. They ensure that a team can retrace their entry route to the Control Point even when visibility is nil. Each wearer of a B.A. set has a "personal line" secured at one end to the set harness. The free end has a snap hook which can be clipped over the guide line.

A main guide line consists of 60 meters of nylon cord carried in a cylindrical canvas container. One end of the cord is attached to the container and the line is laid up so that it pays out through a hole in the lid as the user carries it away from the fixed end.

The container is carried by the team or attached to the harness of a B.A. set. The last man in the team ties the line to convenient objects at sufficient intervals to keep the line off the ground. The knot must be easily untied and a slip knot is normally used.

Two main guide lines may start from one Control Point and these are then marked with an 'A' or 'B' circular tally.

Every $2\frac{1}{2}$ meters along the guide line, two tabs are attached 15cm. apart. One tab has two separate knots while the other is unknotted and longer. The knotted tab is on the "way out" side of the plain tab.

The team leader may decide to start laying a main guide line after he has left the Control Point. In this case, the way back to the Control Point must be well defined and have good visibility.

Up to four branch lines may be attached to the main guide lines from one Control Point. These lines are marked where they start from the main guide lines by a rectangular tally containing 1, 2, 3 or 4 finger-sized holes, so that they can be identified by touch alone.

The Incident Control Point trolley described later carries six similar lines each in a separate container. When used, they function as a main guide line if attached at one end to the Control Point and as a branch guide line if attached as a spur to a main guide line. A person working at the far end of a branch line can be 120 meters away from his Control Point.

A personal line consists of 6 meters of lighter nylon cord secured to a pouch attached to the B.A. set. A 'D' ring is attached to the line $1\frac{1}{4}$ meters from the other end which has a snap hook to clip over a guide line. Normally this 'D' ring is secured inside the pouch so that the wearer is within $1\frac{1}{4}$ meters of the guide line. However, the personal line can be increased to 6 meters to allow the B.A. set wearer to extend his area of movement away from the guide lines.

After a guide line has been laid, all teams should attach the snap hook of their personal line to it or to the B.A. set harness of the man in front, with only the leading man coupled to the line.

Away from the Control Point, the personal line should only be unclipped from the guide line on two occasions. The first is when the team is transferring from a Main Guide Line to a Branch Guide Line, or returning. The second is to allow another team to pass. Out-going teams have precedence in the use of the guide line because their air supply may be low. The in-going team uncouple their personal lines and stand aside to allow the other team to pass.

If personnel do not return to the Control Point, a Rescue Team can find them by following the guide line and the personal line.

If a casualty is found but cannot be brought out, the line can be terminated there so that rescuers can go straight to the location.

Subsequent teams can move rapidly along a guide line knowing that hazards have been avoided.

CONTROL POINT TROLLEY AND EQUIPMENT

A 4-wheel trolley has provided a convenient mobile store for

Control Point equipment. It is small enough to be wheeled through doorways and into lifts, so that it can be brought to the location chosen for the Control Point. Its presence helps to remind personnel of the need to avoid cross-contamination by segregating clean and used equipment, active team members and reserves etc. The Oldbury trolley is about 115 cm x 65 cm x 100 cm tall and the stock of equipment shown in the table below has proved useful in a variety of exercises and simulated accidents.

Radiation Dose-Rate Meter	Contamination Monitor and Probe
Gas-in-Air Detector	Clean Protective Clothing (6 sets)
Filter Packs (6 off)	Battery Operated Air Sampler
B.A. Set & Spare Cylinder	Notice for "Empty Cylinders"
Wax Crayons (2 off)	B.A. Control Boards (2 off)
Telephone Extension Lead	Guide Line & Container (6 off)
Jack-in Telephone	Guide Line Tallies (1 set)
Communications Amplifier	Communication Headsets (2 off)
Communications Lead	U.H.F. Walkie-Talkie Radio
QFE Charging Unit	Dosimeter Issue & Record Forms
First Aid Kit	Hazard Warning Rope (2 reels)
Adhesive Tape (1 roll)	100 cm. wide Plastic Sheet (1 roll)
Plastic Bags (3 off)	Facemask Disinfectant (1 bottle)
Paper Sacks (3 off)	Paper Tissues (1 box)
Torches (6 off)	Chemi-Luminescent Light (6 sticks)
Floor Plans of Plant	Personal Line & Pouch (6 off)

DISCUSSION

For brevity, the preceeding sections have described equipment at Oldbury as examples, but the control principles can be used without such aids. The purpose-built B.A. control board is convenient to use, but a pencil or chalk on a wall or door could provide the essential information of who went where and at what time. The U.H.F. radio system by which each walkie-talkie receives all the messages transmitted reduces delays because trained men can anticipate developments, but the safety of team personnel is not reduced if communications are by telephone. The trolley has provided a useful focal point for the control procedures but other methods of personal discipline can be used to contain the hazard.

Plant employees who are also part-time firemen use similar techniques for non-radiological hazards, so they are not subjected to conflicting training methods on and off site. Reinforcements from full-time services can be deployed on site quickly because the control system in operation will be familiar to them.

These methods have been criticised for slowing down the first stages of rescue or remedial work in an emergency. While it takes time to lay out a guide line initially, subsequent movements in and out of the area are eased and the whole operation may be completed more quickly. During exercises, time scales tend to be shortened because participants do not expect to come to any harm. When the risks are real or the consequences of the accident are not yet known, personnel do not make snap decisions to send teams into areas of danger.