Central Electricity Generating Board
Research Division
Berkeley Nuclear Laboratories

EEC WORKING GROUP
ON HOT LABORATORIES AND REMOTE
HANDLING

1981 PLENARY MEETING -
KARLSRUHE, FEDERAL REPUBLIC OF
GERMANY

THE REFURBISHING OF CAVES AT BERKELEY NUCLEAR LABORATORIES

V. J. Haddrell and M. S. Stagg

SESSION 2. EEC Hot Laboratories and
Remote Handling Group Meeting, Karlsruhe, May 1981

THE REFURBISHING OF CAVES AT BERKELEY NUCLEAR LABORATORIES

- by -

V.J. Haddrell* and M.S. Stagg*

SUMMARY

One cave-line at Berkeley Nuclear Laboratories has been refurbished and approximately 2 years operational experience has demonstrated the effectiveness of the system adopted. A second cave-line is now in the process of being refurbished and the work is being undertaken while maintaining PIE operations in these caves. The proposals for this scheme are described and details are also given of some of the operational and maintenance procedures which have been carried out in the 2 years since the first cave-line was refurbished.

*Berkeley Nuclear Laboratories

INTRODUCTION

The refurbishing of the three cave-line at BNL was described in a paper presented at the BNES PIE Conference of 1980. A second line of caves (caves 4 to 6, see Figure 1,) which were commissioned in 1967 now requires up-dating with new mechanical and electrical services. The approach to this refurbishing, although similar in concept to that followed with the three cave-line, is different in detail because it is essential that interruptions to the PIE programme which is currently being carried-out in these caves,are kept to a minimum. The proposals for refurbishing the second cave-line are described and the 2 years operational experience with the refurbished three cave-line is discussed.

DETAILS OF THE CAVE-LINE TO BE REFURBISHED

The cave-line to be refurbished was commissioned in 1967 and built at right angles and at one end of the three cave-line; a transfer elevator from the fuel storage pond terminates at this point, see Figure 1.

The civil construction is essentially the same as the three cave-line but is arranged with 2 windows between each dividing shield door to give a six window cave-line with a pair of No. 9 manipulators fitted over each window. A power manipulator and travelling crane is installed to cover the cave-line and two hoists with articulated arms are fitted to the rear wall of the middle cave. A maintenance bay with a half suit cubicle is sited at the end of the line. The shielding roof over the major part of the line is made-up of removable and interchangeable concrete beams some of which are fitted with post ports.

Continuous benching, generous services and free-standing equipment were features of the original design which provided flexibility in use and these features were subsequently incorporated in the refurbishing of the three cave-line. In the case of the services however, the original design provided many spare service outlets which could be used as and when a service failed and for this reason the service units were fixed. Three pieces of equipment were also treated as fixed units essentially because of their size. These units were a large waste baler, the bed of the X-ray unit and a large ram used for transferring the elevator skip to and from the elevator and cave-line.

During the 13 years operation of this cave-line it has been possible to respond to the changes in the PIE requirements by replacing and exchanging the free standing equipment and this has greatly reduced man entries; a small number of entries have been made to service the X-ray unit. Unfortunately over the last

two years it has become evident that the electrical services are deteriorating due to the breakdown of insulation. Similarly the hydraulic services are also suspect due to the deterioration of the seals; the baler no longer functions and the seals of the transfer ram are leaking. As the magnox PIE programme is a continuous commitment the feasibility of replacing the fixed equipment and the mechanical and electrical services, while still maintaining continuity of the PIE, was studied. Any man entry, by the nature of the operation, would introduce significant interference to the PIE operations so it was essential to find ways of refurbishing these caves without man access.

THE PROPOSALS FOR REFURBISHING

As the work benching, general handling, viewing and lighting were quite adequate it required only new services and alternatives to the suspect fixed equipment to bring the caves up to standard. It was decided that any new service must be capable of being withdrawn and this requires penetration of the shield walls. The rear wall was not acceptable because the existing service consoles cover the length of the rear interior wall and it would be technically and ergonomically unsatisfactory. Fortunately there are two existing 115 mm ($\sim$ 4.5 inches) dia holes in each cave at an ideal height through the wall of the operating face, see Figure 1, and by careful design it was possible to produce a service plug for the mechanical services (hydraulic/pneumatic) and a similar plug for the electrical services which would fit into these holes. These plugs project out into the cave to give sufficient viewing and handling cover for connecting and disconnecting the services by manipulator. The service plugs are fully shielded and incorporate a sealing gaiter for use when the plug is withdrawn from the cave. Each service terminates with a connector on the operating face and from this connector the hoses or cables are routed to control consoles which fit under the windows. To allow continuity of services with the minimum interference to the operations it is proposed that these consoles should be free-standing in the initial stages and positioned nominally at right angles to the cave face. Only when the services to the in-cave equipment have been transferred from the existing services to the new service plugs will the old consoles be disconnected and removed and the new consoles positioned in their place.

The fixed waste baler which has failed will be disconnected and covered to provide a useful storage space; a new free-standing baler has already been provided. In the case of the existing ram for transferring the skip from the pond elevator, this will be replaced by a new removable ram fitted into the hole

to be drilled through the opposite shielding wall in-line with the existing ram, see Figure 1.

All of these proposals essentially overcome the immediate problems of bringing the services and equipment into working order. Man entries will be unnecessary and interference to the PIE programme will be reduced to a minimum and should be measured in days rather than weeks. Subsequent maintenance work will be greatly facilitated and man entries will be unnecessary.

OPERATIONAL EXPERIENCE OF THE REFURBISHED THREE CAVE LINE

The refurbished three cave-line, which was reported at the 1980 BNES PIE Conference has been in constant use for approximately 2 years. The operations include visual and photographic examination, mensuration, dismantling and machining. This experience has highlighted a number of aspects. For instance, changing technology, particularly in the field of mensuration, has shown the need for special electrical connectors which were not provided in the refurbishing scheme. It was also found that because of the more effective bench space and the conscious policy of reducing the size of in-cave equipment, more equipment can be installed and this has lead to an inadequate number of services. Rather than changing the existing service units to provide the special connections and the additional outlets, it was decided to drill additional holes through the operating face wall for removable service plugs. No difficulties were experienced during these drilling operations.

The effectiveness of the smooth uncluttered work benches, combined with the readily removable free-standing equipment, was demonstrated when it became necessary for man entries to repair the elevator in the tunnel adjacent to cave 1, see Figure 1. The entry was made via cave 1 which had been used for dry drilling and abrasive cutting of highly irradiated stainless steel and nimonic alloys and was therefore highly contaminated. It was possible to transfer all of the radioactive sources and the free standing equipment into the next cave within hours. The decontamination of the worktop and adjacent walls, down to residual radiation levels in the order of 3R/hr γ, was possible within 2 days by using the manipulators, carbon tetrachloride and a window cleaning squeegee. While the decontamination of mixed fission products may be more difficult the benefits of equipment-free smooth benching were clearly demonstrated.

Although a power-manipulator was installed when the caves were built it was decided it would not be included in the refurbishing concept as it was thought it would be more advantageous if relatively heavy handling could be carried out simultaneously throughout the cave-line as this should lead to a more efficient

use of the facility. To make this possible wall hoists were installed in each cave for the 'heavy' handling and these have been extensively used. The lack of a power manipulator is not obvious, the efficiency of the line is high and the breakages rate of the No. 9 manipulator has not increased.

CONCLUSIONS

The experience gained in refurbishing the first cave-line at BNL, the operation of this line and the concept proposed for the refurbishing of next cave-line, suggests that the majority of cave-lines are potentially capable of evolving, by refurbishing, to meet new operational requirements. Such an approach should reduce the need for new remote facilities with consequent savings in costs and time. The considerable problems of decommissioning older facilities and the attendant disposal of waste arising can be postponed indefinitely.

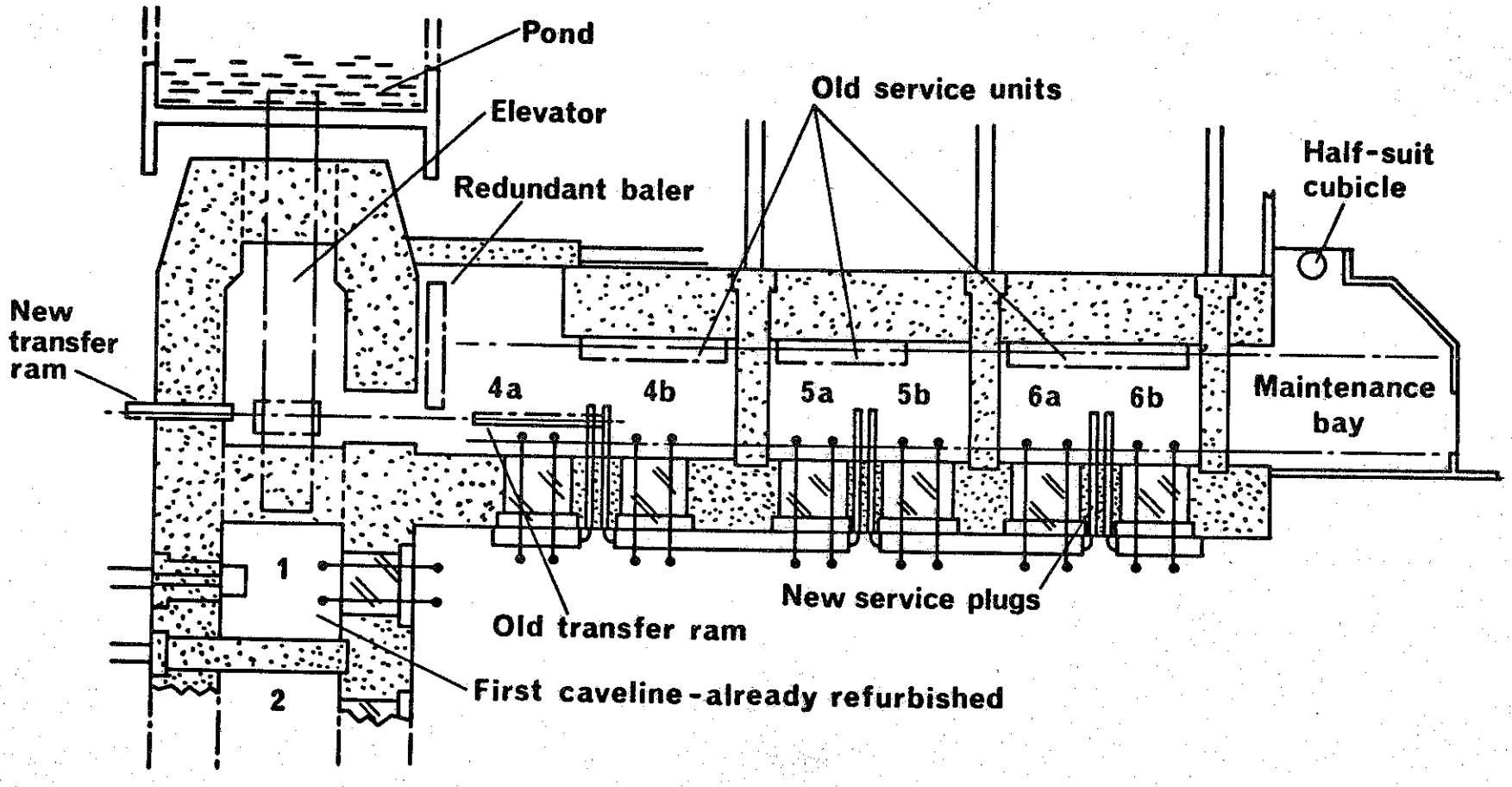

Fig 1 : Layout of Caveline.

DISTRIBUTION

Mr. A. C. Demildt	SCK/CEN, Boeretang 200 - B 2400 Mol, Belgium
Mr. G. Böhme	Kernforschungszentrum Karlsruhe, Abt. RBT-IT, Postfach 3640, D-7500 Karlsruhe, Federal Republic of Germany
Mr. H. Müller	Kernforschungsanlage, Heisse Zellen, D-517 Julich 1, Postfach 1913, Federal Republic of Germany
Mr. H. Hougaard	Danish National Laboratory Risø, DK-4000 Roskilde, Denmark
Mr. G. Lefort	DSN/SESLU, Centre d'Etudes Nucléaires de Fontenay-aux-Roses, BP No 6, F-92260 Fontenay-aux-Roses, France
Mr. G. Pugnetti	CNEN, Laboratorio Operazioni Calde - Casaccia, Casella Postale N 2400, I-00100 Roma, Italia
Mr. H. J. Wervers	Energie Onderzoek Centrum, Petten (NH), The Netherlands X
Dr. S. A. Cottrell	Atomic Energy Establishment Winfrith, Dorchester, Dorset, DT2 8DH
Dr. V. W. Eldred	Windscale Nuclear Power Development Laboratories, Sellafield, Seascale, Cumbria, CA20 1PF
Mr. G. Samsel	Europäisches Institut für Transurane, Postface 2266, D-7500 Karlsruhe, Federal Republic of Germany