RECRUIT/TRAINING OF AEC PERSONNEL FOR OPERATIONS OF HIMAC FACILITY

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Abstract

AEC's major jobs in HIMAC facility are operation and maintenance of the accelerator complex, but are also included technical supports of heavy-ion cancer therapy, relating treatment planning and physics & biology experiments, and facility support and management. We have been carrying out all of those jobs under the auspices of NIRS. Required technologies are widely spread due to such various service and support jobs. Most of the personnel have different backgrounds and are usually not accelerator-related. Recruiting and hiring personnel and their training are important and ongoing matter.

1 WHAT'S AEC

Accelerator Engineering Corporation (AEC) is a private company, which was founded in 1992 by the joint investment of four accelerator makers and other two companies, with the purpose of carrying out operation and maintenance of HIMAC (Heavy Ion Medical Accelerator in Chiba) facility at National Institute of Radiological Sciences (NIRS) in Chiba Prefecture [1]. Since then, AEC has been expanding its service and support jobs in HIMAC under contract with NIRS. Our present major jobs are to carry out:

- operation and maintenance of HIMAC accelerator complex, constituting of ion sources (PIG, ECR, HEC), injector linac's (RFQ and DTL), heavy-ion synchrotrons (2 rings), high-energy beam transport lines, and irradiation systems for cancer therapy and relevant experiments,
- irradiation treatment support for carbon-ion cancer therapy,
- relevant treatment planning support,
- technical support of physics and biology experiments, and
- maintenance of buildings and equipments .

Also are included operation and maintenance of NIRS cyclotron facility, which composes of a large isochronous cyclotron (NIRS-930), a small cyclotron (HM-18) and nine experimental beam lines [2]. In addition, from 1996, the preventive semi-annual maintenance jobs of HIMAC in August and March have been put into AEC's responsibility.

Besides the operation and maintenance, we are expected to perform R&D works on power supplies, beam monitors, radio frequency acceleration, vacuum system and other relevant fields, under suggestion of and in collaboration with NIRS researchers. The recent operational experience in HIMAC is presented elsewhere in these proceedings [3], on both operation and maintenance aspects for highly reliable and stable beam supply. Accumulated total number of treated patients in HIMAC became over one thousand in early 2001. Then, the number has been increasing at twenty percents or more per year. Our medical support jobs are increasing with the patient load.

During beam commissioning of HIMAC, the engineers of the accelerator makers and related companies engaged in the accelerator operation. After successfully finishing the commissioning, AEC received them as loaned staffs for the help of continued operations of HIMAC. We appreciate their cooperative and helpful activities and call them "cooperative personnel". At the present stage, the number of AEC's personnel is one hundred and sixteen including cooperative personnel. The number of the engineers belonging to HIMAC's operation and technical support groups, with the exception of facility maintenance, is fifty-three, averaged around thirty-one years old. AEC's engineers have to engage in a wide variety of activities, which range from performing safe and efficient operation of the accelerator to supporting experiments using delivered ion beams. We need engineers of various fields: mechanics, electronics, accelerator physics and engineering, radiation handling, machine control system etc.

Here, a special mention is that AEC has recently received a contract from Hyogo Ion Beam Medical Center (HIBMC) in Hyogo Prefecture, for operation of the particle therapy facility, PATRO (Particle Accelerator for Therapy, Radiology and Oncology), which is a medical-dedicated accelerator complex with a proton & carbon-ion synchrotron [4]. We are pleased that HIBMC has evaluated our technical experience and skills cultivated in operations of HIMAC facility. AEC's thirteen proficient operators, trained in upgrade level at HIMAC, start to carry out regular operation of PATRO in the beginning of this coming April.

2 RECRUITMENT

Usually, it is very rare to recruit and hire employees who have previous experience in accelerator operation or specific skills needed to operate an accelerator. We fortunately have had cooperative personnel with extensive operational experience for HIMAC and senior personnel

becoming experienced during the beam commissioning of HIMAC. The cooperative personnel are those who are sent from accelerator makers and relating companies on loan. AEC had started HIMAC operation jobs with the help of those cooperative personnel. Since then, although most of the cooperative personnel returned gradually to their home companies, some of them have become to be our permanent ones. With decreasing cooperative personnel and expanding service and support jobs, we have had to recruit and hire new employees almost every year. During ten years since 1992, we have employed sixty-nine individuals in total, and those of twenty retired. Most of the personnel have different backgrounds and are usually not accelerator-related. Therefore, recruiting and hiring personnel and their training are important and ongoing matter.

The first stage of the recruiting and hiring process is to get good candidates. Our efforts of recruiting recent graduates expand from universities and graduate schools to vocational and technical schools, mainly through private communication and recommendation and by posting on local bulletin boards at universities and schools. Hiring efforts are widely made by advertising on dedicated home pages and magazines. As desired fields of employed individuals, we inform of mechanical engineering, accelerator engineering, analog & digital electronics, computer control, and hard & soft wares etc.

The second stage is to review the written applications and resumes. The third stage is to screen for getting good prospects for the interview. In the fourth stage, the candidate gets a tour of HIMAC facility and operation areas, before the interview.

The fifth stage is the candidate's interview, at which we briefly explain the accelerator, its operation and shift work, and the candidate introduces his own job experience or school study and self-motivation. In the interview, we intend firstly to appreciate good personality and positive motivation, secondly to expect good communication skill and footwork ability, and thirdly to check basic knowledge and skills. After the discussion among the interviewers, other senior and management staffs, the headquarters makes the final decision.

Although we have had success recruiting externally, we have hired a few qualified candidates from other research organizations and accelerator makers.

3 TRAINING

Once we recruit and hire new employees, we must provide adequate training for them. The training program is a combination of training lectures, on-the-job training (OJT), and self-study.

The initial program is collective lectures by senior personnel and OJT in the accelerator control room. The introductory lectures intend to provide a fundamental understanding of the facility, its systems and its operation, such as beam operation, beam optics, ion source, injector linac's, synchrotron, irradiation system, etc. Among the lectures, regular training courses are included on radiation protection and occupational safety issues. Then, respective expert staffs give lectures on specific parts of the accelerator in rather details: high-energy beam transport line, power supply and electromagnet, cooling water system, vacuum system, RF system, beam monitoring, computer and control system etc. In non-lecture times, the trainees stay in the accelerator control room, learning how the accelerator system is controlled and operated, under the guidance of an operation crew leader on duty. At the end of this initial program, the trainees receive an evaluation test on viewing their general understanding and submit short reports on specific operation subjects. If the trainees do not complete the evaluation, the evaluator identifies areas for further self-study.

In the second program, the trainee is successively, in a period of one to two weeks, attached to respective group of the accelerator operations, experiment support and irradiation support, and starts first-stage OJT, where he learns and understands how each group is working, participating in certain job under the guidance of an instructor or group leader. On leaving each group, the trainee is required to make up a report regarding the operation job that he carried out. In the third stage, we formally set him in one of the working groups and starts OJT in higher level, and deals with real practice under man-to-man direction of a specified instructor.

After finishing the lecture program of two months and the initial OJT of next two or more months, the trainee becomes to deal with in regular operation, designated as an operator trainee.

A few or several months later, the evaluator conducts an evaluation using the applicable standard as a metric in determining whether the trainee's knowledge and/or skills reach to expected levels. The operator trainee demonstrates his understanding of and ability to perform real job tasks. If the operator trainee completes this final evaluation, he is promoted to a regular operator.

4 ADVANCED TRAINING, DEVELOPMENT AND FUTURE CONCERN

Training begins with recruiting and hiring and ends with retention. Emphasis is placed on self-study program not only to maintain, but also to enhance, the skills and knowledge acquired. Required knowledge for machine operation and maintenance is widely spread, and our personnel have to upgrade their knowledge continuously to keep pace with facility changes and improvements. Steps in between include professional development and career advancement. We, in regular manner, perform exchanging personnel between the groups, for extensive operational experience and expanding technical fields and abilities.

Off-shift and downtime projects are encouraged because they provide opportunities for in-depth study of specific aspects of accelerator operation and maintenance. During non-operational periods, specified talks or reports

are given on projects, new equipment or system and changes in the accelerators and are used to maintain and enhance operator's proficiency. These lectures are provided by system experts and are videotaped for viewing of those unable to attend. These videotapes also serve as training materials for future operators.

Although the direct application to machine operation and maintenance is usually limited, supplemental outside training at technical training courses, business seminars and laboratory training sessions, participation in relevant symposiums on accelerator engineering, radiation handling and specific technologies, and acquirement of authorized qualifications such as radiation protection, electronics, electricity, information technology etc. are also encouraged

Our company has celebrated the tenth anniversary last year, and the present personnel have averaged thirty-one years old, being still a young organization compared with other companies. However, taking account of next five or ten years, a foreseen concern is how long a person can work as an operator. The stress of working rotating shift including night shift may cause a senior person to seek a position with normal working hours. This does not necessarily mean that the person is seeking to leave accelerator operation. However, the number of such senior positions available is limited. We have to find out new jobs or positions for senior personnel in neighboring and relating fields to that of accelerator operation.

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