CONTROL MEASURES FOR RADIATION EXPOSURE AT JET

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ABSTRACT

The JET Joint Undertaking is a collaborative project between UKAEA and EURATOM investigating nuclear fusion as an energy source for the future. With the introduction of beryllium in 1989 and the use of tritium as a fusion fuel in 1991 and 1997 there have been increased radiological and chemical hazards associated with JET experimental programme and associated operations. This paper provides an overview of engineering control measures at JET at an operational level, citing recent examples of containment, confinement techniques and developments in the selection and use of respiratory protection.

INTRODUCTION

The JET reaction vessel or torus is a doughnut shaped vacuum chamber, 3m radius, fabricated from iron-nickel alloy, clad with a protective layer of graphite tiles to provide a surface compatible with the conditions necessary for fusion reactions to occur. In 1989 beryllium was selected as a material to supplement the use of graphite, either as a solid wall cladding material or as a thin evaporated layer on all plasma facing components. Since beryllium is a toxic material with a Maximum Exposure Limit of 2 $\mu g\ m^{-3}$ it constitutes a hazard in its own right irrespective of any accompanying radiological hazard. In 1991 and again in 1997, 0.1g and 35g of tritium were injected into the torus (37 TBq and 12600 TBq respectively). This left behind an atmosphere of typically GBq m^{-3} quantities of tritium within the torus and surface contamination levels of the order 10MBqcm^{-2} on in-vessel components[1]. These contamination hazards constitute an exposure risk on each occasion when the vacuum boundary is breached or when personnel enter the vessel or associated facilities.

A conventional hierarchy of control measures is adopted in order to mitigate the hazards to workers, including:-

- procedural controls
- containment
- confinement
- contamination control techniques and
- selection of respiratory protection

PROCEDURAL CONTROLS

Before any operation with an associated hazard is undertaken a number of procedural issues must be addressed in accordance with the JET safe system of work and JET codes of practice[2]. Depending on the magnitude of the hazard a general safety assessment will be raised with a specific radiological assessment identifying the hazards and declaring the countermeasures to be employed. These radiological assessments also quantify the potential discharges and specify the control measures to be taken. They will also address