RADIATION PROTECTION ISSUES AND TECHNIQUES IN SUPPORT OF LUNAR BASE OPERATIONS by Dr. Joseph A. Angelo, Jr. (EG&G, Inc., 100 Eyster Blvd., Rockledge FL 32955), Dr. Richard G. Madonna (Grumman Corporate Research Center, Bethpage, NY 11714), and Mr. William Quam (EG&G Santa Barbara Operations Group, Goleta CA 93117)

Long-term exposure to ionizing radiations, even at presumably "low levels", could have harmful effects on human beings and sensitive electronic equipment. The natural radiation environment on the lunar surface (consisting of galactic cosmic rays [GCRs] and solar energetic particle [SEP] events) as well as manmade radiation environments from nuclear power supplies (active and spent) and particle accelerator facilities could severely limit the durations and types of manned lunar base operations now currently being proposed. Such natural and artificial radiation environments might also limit the operation or functional capabilities of smart second and third generation lunar robots. For extended lunar base operations, real-time radiation dosimetry will be required for habitats, work places, individual space workers and even radiation sensitive robot systems and scientific instruments.

This paper discusses the steps that have now begun to tackle the problem of accurate and reliable real-time radiation dosimetry for a variety of lunar base operations. Natural radiation hazards on the lunar surface involve solar energetic particle events and galactic cosmic rays with their relativistic and near-relativistic atomic nuclei ranging in energy from 10^8 to 10^{20} eV. The manmade radiation sources that could be associated with an evolving lunar base/settlement complex might include operating and spent space nuclear reactors (e.g. modified SP-100 class space reactors), high energy particle accelerators, and (to a lesser radiation environment consequence) radioisotope thermoelectric generators (RTGs) that are fueled by the radioiosotope, plutonium-238.

In a recent innovative space radiation dosimetry program, instrumentation that was not initially designed for in-cabin use on the U. S. Space Shuttle, was modified and qualified for man-rated space flight and then successfully flown on a number of missions, including STS-6, 8, 11, 41-C, 41-D, 41-G and 51-A. The performance of these pathfinder instruments is described. These discussions are complemented by a description of advanced versions of such active dosimetry instruments which are suitable for future Space Shuttle and Space Station applications. Active radiation dosimeters that have been operationally demonstrated on the Space Station would then form the core radiation protection instruments for lunar base operations. Special emphasis is

also given to the need for expanded work in proton and HZE radiology studies, complementary ground-based instrument calibration programs and on-orbit demonstrations.

References:

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