Title: Space Radiation and Central Nervous System Impacts: NASA Standards and Evidence

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It is well understood that large radiation localized doses to the brain cause clinically significant impacts to the central nervous system in human populations. However, the effects in adults exposed to lower doses remain unclear due to lack of data in relevant human cohorts. The impact of exposure to high-energy particles is even less understood. NASA's Human Research Program relies heavily on model systems to characterize the impacts of the space radiation environment on the human brain and how potential changes may effect mission success and long term health and well-being. Animal, cellular, and molecular experiments implicate multiple – and possibly related – mechanisms that mediate impacts to the central nervous system in model systems including, but not limited to inflammation, immune responses, oxidative stress, metabolism, myelination, molecule transport, electrophysiology, and a variety of "omic" changes. While animal studies demonstrate potential changes across a number of cognitive and behavioral domains the direct applicability to the astronaut population remains unclear. Furthermore data access experiments and model systems can be inconsistent and dependent on multiple experimental variables indicating a clear need for robust validation. To minimize potential impacts to astronauts NASA limits dose to the CNS based on a combination of terrestrial epidemiology informed by experimental evidence in model systems. To date no recommendations have been provided by the National Committee on Radiation Protection and Measurements. This presentation will provide an overview of NASA's current dose limits for CNS exposure to space radiation as well as highlights of the current state of evidence and ongoing research.