

National Aeronautics and
Space Administration

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Reply to Attn of: Mission Assurance Standards and Capabilities Division

To: NASA Personnel Involved in Nuclear Flight Safety Activities

From: Chief Health and Medical Officer
Chief, Safety and Mission Assurance

Subject: Categorical Relief for Launches and Reentries Involving an A2 Mission
Multiple Less Than 0.001

For over 50 years, NASA has launched and reentered payloads containing radioactive material. The isotopes, quantity, and form of these radioactive material payloads vary significantly. The handling of this material prior to its integration into the spacecraft at the launch Center (and subsequent to return, if applicable) falls under the purview of the Office of the Chief Health and Medical Officer's activities related to the oversight of ionizing radiation. The requirements for this Program are currently in NASA Procedural Requirements (NPR) 1800.1E, Chapter 4, "Environmental Health," and the launch Center activities are carried out by the Center's Radiation Safety Officer. [1] Once the radioactive material is integrated into the spacecraft at the launch Center, it falls under the purview of the Office of Safety and Mission Assurance's (OSMA's) Nuclear Flight Safety Program and the associated nuclear launch authorization or concurrence process. The requirements for this Program are currently in NPR 8715.26, "Nuclear Flight Safety." [2]

Prior to 2022, all radioactive material was subject to a launch authorization or concurrence process, regardless of its potential hazard, though the process itself was graded based on the A2 mission multiple. By memo dated January 15, 2021, OSMA proposed a change to this paradigm [3]. That memo included historical information and the rationale for the change, and it proposed a new "categorical relief" threshold based on qualitative arguments with a commitment to perform a quantitative assessment to affirm or alter the selected interim threshold. The threshold proposed was an A2 mission multiple of 0.001. For missions falling below this threshold, OSMA proposed that NASA Programs and Projects could rightfully take a notification-only posture, rather than seeking explicit concurrence from OSMA.

In February 2022, with the issuance of NPR 8715.26, OSMA codified this new Categorical Relief approach. NPR 8715.26 defines the term Categorical Relief as, “A memorandum co-issued by the Chief, SMA, and CHMO, which outlines conditions where OSMA nuclear flight safety concurrence is not required owing to the small degree of radiological risk of the mission relative to the assurance provided through NASA’s routine oversight of the handling of radioactive materials, and separately, of payload and range safety activities. When a launch or reentry meets these prescribed conditions, a waiver is not required for any requirements in this directive that specifically states inapplicability upon the invocation of categorical relief (a.k.a., a blanket concurrence).” To be clear, a NASA program or project’s use of the categorical relief process does not affect the requirements of other related processes, including the tracking of radioactive material for the purposes of compliance with external authorities’ possession, use, and transportation requirements.

For the relevant requirements, NPR 8715.26 includes terminology like, “except where an Office of Safety and Mission Assurance (OSMA)-issued categorical relief memo is being applied (in which case only a notification is required).” OSMA intentionally established the categorical relief threshold via separate memo, rather than including it directly in NPR 8715.26, such that more evidence could be obtained, and adjustments could be made (if necessary) in a more agile manner.

Since the January 2021 memo, the involved personnel developed a technical basis for affirming or adjusting the categorical relief threshold initially proposed. Recently, a public summary of that work was published [4] and a more detailed companion document that includes sensitive information was produced and issued internally [5]. That study’s quantitative analysis and associated risk-informed decision affirmed that the previously proposed categorical relief threshold is appropriate without further adjustment. As stated in Chapter 5 of Ref. [4]:

“The analysis performed here has demonstrated that such missions will compare favorably with relevant safety and risk criteria, even when generic assumptions are made, with some of these assumptions skewing results toward a conservatively biased direction where underlying information is insufficient to support a more realistic treatment. Treatment of uncertainty, including uncertainty propagation and sensitivity analysis, have demonstrated the robust nature of this finding. Peer review by external peers has further confirmed the analysis’ validity. Finally, factors other than quantitative consequences and risk have been considered. Based on the totality of this information... Missions with an A2 mission multiple of 0.001 or less may utilize the categorical relief treatment. As stated elsewhere, this threshold should not be construed to indicate that missions with A2 mission multiples greater than 0.001 pose undue risk. On the contrary, factoring in mission-specific information (e.g., vehicle reliability, radioactive source physical and chemical form, engineered safeguards, relevant receptor restrictions) may result in risk estimates that are lower than the ones tabulated herein.”

That same passage points out that during the period of 2012 to 2021, 21 of 25 NASA spaceflights involving radioactive material would have been able to use this categorical relief

treatment. As such, selecting a more aggressive (higher) threshold would not have significantly altered the number of missions able to leverage the categorical relief approach, despite it being set at a low-enough value so as to be robustly supported through generic analysis.

Since the issuance of NPR 8715.26 in February 2022, NASA Programs and Projects have had the option of invoking the categorical relief concept using the previously proposed, and now affirmed, threshold by notifying OSMA of the forthcoming launch. (The Radioactive Materials On-Board Report template contained in NPR 8715.26 Appendix F provides a simple set of information to be provided.) The first launch or Earth return using the categorical relief concept occurred in August 2022. In both Ref. [1] and Ref. [5], a key element of the categorical relief approach is the periodic review of its use by the NASA Nuclear Flight Safety Officer. Such a review will occur annually, and in fact, the first instance already occurred. [6] That first instance also affirmed the appropriateness of the existing threshold, and the adequacy of the early use of the process.

Based on the foregoing information, we affirm that a categorical relief threshold corresponding to an A2 mission multiple of 0.001 is suitable for use in accordance with the definition of this process in NPR 8715.26.

James D. Polk
Chief Health and Medical Officer

W. Russ DeLoach
Chief, Safety and Mission Assurance

Reference:

- [1] “NASA Occupational Health Program Procedures,” NASA NPR 1800.1E, March 16, 2023.
- [2] “Nuclear Flight Safety,” NASA NPR 8715.26, February 3, 2022.
- [3] “Categorical Relief for Launches and Reentries Involving an A2 Mission Multiple Less Than 0.001,” memo from OSMA Nuclear Flight Safety Assurance Manager to the Chief Health and Medical Officer and the Chief of Safety and Mission Assurance, January 15, 2021. [Non-public]
- [4] “Technical Basis Related to the Posture of NASA’s Office of Safety and Mission Assurance for the Launch of Radioactive Material Other than Space Nuclear Systems: Volume 1–Overview of Analysis and Results,” NASA NTRS Document ID 20230002528, February 22, 2023.
- [5] “Technical Basis Related to the Posture of NASA’s Office of Safety and Mission Assurance for the Launch of Radioactive Material Other Than Space Nuclear Systems: Volume II – Details of New Analysis Performed,” NASA NTRS Document ID 20230002538, February 22, 2023. [Non-public]
- [6] “Review of Calendar Year 2022 Usage of the Nuclear Flight Safety Categorical Relief Limit,” Memo from the OSMA Nuclear Flight Safety Officer to the Director of Mission Assurance Standards and Capabilities Division, February 23, 2023.

cc:

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