

Call for action to NASA to fix the EIS and to work to make sure NASA's actions are accepted and understood internationally before resubmitting it as recommended by Rummel et al, the ESF and others

We, the undersigned, call on NASA to

- fix the inaccurate cites to bring the draft EIS up to the standard of a peer reviewed paper in Nature or Astrobiology
- expand the EIS to include alternative actions that keep Earth 100% safe from samples returned from Mars
- add capabilities to return samples of the dust, atmosphere and a scoop of dirt to the Orbital Capsule returned in 100% sterile containers - the mission as described has permitted levels of biosignatures in the sample tubes that will make it impossible to make even a first step in addressing central questions in astrobiology about either past or present day life on Mars and are sure to lead to false positives where biosignatures of life are detected which are from Earth and not Mars.
- unless the decision is to keep Earth 100% safe through sterilization, initiate the next size limits review mandated in the ESF report
- set up the recommended planning and oversight agency with the participation of ethicists, lawyers and social scientists and open to representatives from all countries, as recommended by Rummel et al, the ESF and others
- Resubmit the new EIS only after NASA's actions are well understood and accepted internationally

We don't think it is acceptable to continue with this EIS until NASA's actions are more widely accepted given the high level of concern and even panic shown by the public responses.

In addition, public responses to this EIS may not only derail this mission as proposed but also cause problems for future well conducted safe missions we may try to do by modifying it.

This is a draft statement, and is not yet open for signature - please contact me if you are interested to sign it when ready or have suggestions, comments, questions or see anything to fix however small, Thanks!

In more detail:

We the undersigned call on NASA to

1. **Fix all the inaccurate cites in the draft EIS** including any of the inaccuracies described here that stand up to independent peer review. The aim should be to bring it up to the standard of a paper published in Astrobiology or Nature. The reviewers should include astrobiologists of high standing who are not directly involved in planning this mission. This should include adding and accurately summarizing the relevant information in the missing cites ([Ammann et al, 2012](#)) and ([Board, 2015](#))
2. **Expand the EIS by adding alternative actions that keep Earth 100% safe from samples returned from Mars while preserving as much as possible of the science return.** This should include the first two actions described here as well as any others that NASA may wish to add that achieve the same result (such as the third action if this is feasible).
3. **The levels of contamination permitted in the sample tubes will make it impossible to make even a start on central questions about astrobiology and make it next to impossible to certify samples as free from viable extant Martian life,** and we call on NASA and ESA to add samples returned in 100% sterile containers to the Orbital Capsule such as a sample of dust, and atmosphere using a compressor like the one used for Moxie, and a scoop of dirt preferably containing a sample of the temporary brines found by Curiosity. In addition the level of contamination is such as to guarantee false positives in the form of biosignatures of life that seems to be from Mars but are actually from Earth
4. **Unless the decision is to keep Earth 100% safe through sterilization, NASA needs to initiate the size limits review** mandated by ([Ammann et al, 2012](#)) This needs to be done as soon as possible to reduce delays
5. **As soon as possible, convene the advanced planning and oversight agency and international framework** as recommended by the Mars sample return experts.
6. This is necessary even if the decision is made to keep Earth 100% safe through sterilization of all samples returned to Earth. NASA engineers shouldn't assume that it is enough for them to know it is 100% safe, it is important that the general public also understand this. The planning and oversight agency is still needed to coordinate with the general public and avoid issues such as uninformed people panicking unnecessarily, conspiracy theories, distrust of NASA and attempts to sabotage the missions.
7. **To resubmit the new EIS only after NASA's actions are well understood and accepted internationally** as a result of doing it through such a process

We don't think it is acceptable to continue with this draft EIS until NASA's actions are more widely accepted, given the high level of concern and even panic shown by public responses to the draft EIS so far.

In addition, public responses to this EIS may not only derail this mission as proposed but also cause problems for future well conducted safe missions we may try to do by modifying it.

Signed:

Robert Walker

Background information

The draft EIS is full of inaccurate cites, which misrepresent the sources used. Amongst the most obvious:

- It claims a consensus amongst astrobiologists that the surface of Mars has been uninhabitable for life for millions of years. I am unable to find one astrobiologist who has published papers or said in an interview that Mars is definitely uninhabitable and the most recent 2022 source they use for this statement talks only about a “seemingly uninhabitable” planet and the need to search for potential microhabitats and if found, to then search for life.
- It claims that if there is life on Mars it won't have got to Jezero crater. As a source for this they use the 2014 study by Rummel et al and don't cite the 2015 study commissioned by NASA and ESA that overturned or modified many of its findings including the finding that habitable areas of Mars can be delineated by maps using orbital studies – the 2015 study specifically talks about transport in the dust and microhabitats and which pointed to these as knowledge gaps. These knowledge gaps haven't been filled in the 7 years since 2015.
- It claims that a biosafety level 4 laboratory is sufficient to contain any life in the samples if they do return life. To support this they use the 2009 National Research Council study and don't cite the 2012 European Space Foundation study which reduced the limit from 0.25 microns to 0.05 microns based on research conducted between 2009 and 2012, and which also stressed the need for periodic review given the dramatic reduction in the size limit in just 3 years. This review hasn't been done.
- It claims that any life that can get here in the sample can get here more easily via meteorites. The source they use for the claim that life can't be sterilized by ejection from Mars is a study of ejection from Mars to Phobos, which requires a much lower delta v

than ejection to Earth and it also specifically says that they were not required to look into the possibilities of sterilization during the ejection process and didn't study this.

The draft EIS also only presents No Action as the alternative to returning unsterilized samples to a BSL-4 facility on Earth and then sterilizing subsamples for other laboratories. Their plan would have been acceptable for the samples returned from the Moon in 1969 based on the understanding of the Moon in 1969. It is not appropriate for samples returned from Mars now with the understanding we have now of the possibility of microhabitats on Mars.

In particular Mars has an atmosphere that varies around the triple point of water where liquid water can coexist with ice and water vapour while the Moon has no atmosphere and this was already known in 1969. Also our understanding of the capabilities of extremophiles and the limits of size of microbes has advanced hugely since 1969.

An EIS is required to present alternatives to the proposed action. The only alternative presented here is "no action".

This study doesn't consider the possibility of taking more care than BSL-4 or of returning samples sterilized (the simplest solution) or studying unsterilized samples in a safe location not connected to the terrestrial biosphere until we know they are 100% safe and returning sterilized samples to Earth immediately.

Nearly all the required science for geology can be conducted on sterilized samples.

The permitted levels of contamination for the sample tubes will make it next to impossible to prove that the samples DON'T have life in them leading to a certainty of a false positive detection of life in the sample So there is an urgent need for astrobiology of returning samples in a sterile container.

As a rough calculation the permitted levels of biosphere are enough so that many thousands of ultramicrobacteria could be present per tube and many millions of hypothetical RNA world ribocells, and the biosignatures from them would remain below the permitted levels of contamination.

For details with cites see this preliminary analysis of the EIS and first response:

Why NASA's Environmental Impact Statement is vulnerable and easy for anyone to stop in courts, or the courts could issue injunctions such as requiring sterilization to protect Earth's environments - fails to consider impacts and limits set in sample return studies by the NRC and ESF – and doesn't adequately taken account of previous comments from concerned members of the public referring to these studies – and how this can be fixed

[Will upload this to OSF as a preprint]