

Burn Chemical Eye CLIFF Peer Review

1. *Strength of evidence presented in CLIFF in modeling the characteristics and mission impact of this medical condition within the spaceflight environment?*

Score: 3

Grading Scale:

4 - *Confident*

3 - *Somewhat confident*

2 – *Neutral*

1 – *Somewhat unconfident*

0 – *Not confident*

2. How confident are you that these data accurately represent the spaceflight environment?	Tables 1, 2 Composite Incidence and Level of Confidence	Table 3, 4 BC/WC Loss of Crew and probability	Table 4 - Clinical Phase 1, 2 durations Table 5 – CP 2 Loss of Crew	Table 4 – RTDC % Table 6 – RTDC Loss of Crew	Table 4 – Loss of Crew Life % Table 7 – Loss of Crew Life, Loss of Crew	Table 8 – TI
Score	3	2	3	3	3	3

Comments and limitations:

1. General comments. This CLIFF characterizes chemical burns that affect the eyes. There is a separate CLIFF that addresses chemical burns to the skin. The nature and severity of a chemical burn varies widely and is dependent on the individual chemical. Predicting the incidence of burns along with their severity is difficult without knowledge of the hazardous substances carried on board. The risk also depends on the engineering safeguards built into the system to mitigate the risk of exposure. Most cases of chemical eye burns can be prevented with the use of proper eye protection. There have been several reports of chemical eye burns during shuttle, MIR, and ISS missions. The best case is considered to be a chemical exposure to the eyes in which tear pH normalizes within a few minutes and no permanent corneal scarring is expected. The worst case is a chemical exposure to the eyes in which tear pH does not normalize within a few minutes, or results in significant scarring/ulceration, or that results in intra-ocular pressure changes.

2. Incidence. Since there have been reports of chemical eye burns during spaceflight, this data was used to calculate the incidence for this medical condition. The incidence of a chemical burn is going to be dependent on the chemicals carried on the specific spaceflight and may vary widely from

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the estimated incidence calculated here. The best case/worst case probabilities used data from a study conducted in Singapore that reported a hospitalization rate of 10% among chemical eye burn patients. Hospitalization was used as a surrogate for the worst case. The clinical phase durations, RTDC and Loss of crew life probabilities are supported by terrestrial evidence, and I am in agreement with their calculation. The probability density curve that was derived appears to be a reasonable representation of the data presented.

3. Clinical phase data. I am in agreement with the clinical phase 1 duration entered in this CLIFF. This data was compiled by a team of expert clinicians, and I was involved in the discussions leading to the calculation of the clinical phase duration. CP2 was supported by terrestrial evidence.

4. Task impairment. The analysis was performed and reviewed by a separate team of expert clinicians. I am aware of the methods that were used but did not directly participate in the discussions.

5. Dependence on mission phase or duration of mission. This medical condition is not dependent on mission phase.

6. Limitations

- The estimated incidence is dependent on the specific chemicals that will be carried onboard. Depending on the exact nature of hazardous substances on board and the engineering safeguards built in, the incidence may vary widely from mission to mission.
- Most studies of chemical eye burns reflect general terrestrial populations. These studies were used to derive clinical phase durations, RTDC, and Loss of crew life. Terrestrial studies do not match the unique environment of space.
- There is no literature found that provides severity-stratified incidence on chemical eye burns; therefore, it is difficult to estimate BC/WC probability. The current definition of BC scenario "tear pH normalization within a few minutes" makes it challenging to find studies that inform the BC/WC probability. This is especially true in light of the recommendation of immediate eye irrigation after all incidents of chemical eye burn until pH normalizes.

Reviewed by:

David C. Hilmers