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Blast Injury Prevention Standards Recommendation (BIPSR) Process: Ocular Blast Injury Type

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Abstract

- The BIPSR Process is designed to identify and objectively evaluate the details of candidate blast injury prevention standards to determine their suitability for use by the DoD in health hazard and survivability assessments, as well as in protection system development.

Introduction

- The BIPSR Process provides an unbiased, stakeholder-driven critical assessment methodology for identifying the best biomedically valid candidate MHS blast injury prevention standards currently available.
- The BIPSR Process supports the development and testing of safe weapons and of effective protection systems for combat vehicle crews and individuals. It is not a research program and does not develop new injury criteria or injury prediction tools, but it does inform research by identifying gaps where no suitable standards currently exist.
- The BIPSR Process consists of seven fundamental subprocesses represented by six pillars supporting an overarching process designed to leverage the information from previous phases and building layers of information about the viability of the candidate standards at each phase.

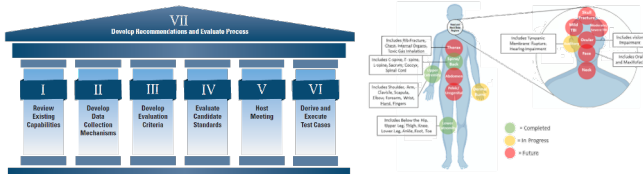


Figure 1: BIPSR Process Pillars.

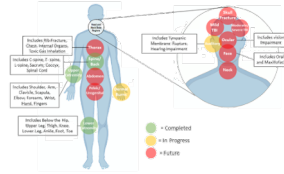


Figure 2: BIPSR Process.

Methods

- Initial activities of the BIPSR Process include a systematic review of biomedical literature on injury risk under conditions characteristic of blasts, interviews with SMEs, engagement with DoD Stakeholders to define intended uses and identify existing standards, and conducting an RFI to locate resources. These activities lead to a set of injury criteria for evaluation as an Ocular Blast Injury Prevention Standard.

Pillar	Sub-process	Activities
I	Review Existing Capabilities	<ul style="list-style-type: none"> Engage Stakeholders and identify relevant standards for the injury criteria through a systematic literature survey Establish a broad-based, independent review panel Hold the necessary meetings (RFI)
II	Develop Data Collection Mechanisms	<ul style="list-style-type: none"> Develop standardized evaluation and information templates Conduct frequent panel meetings to establish review criteria
III	Develop Evaluation Criteria	<ul style="list-style-type: none"> Define scenarios and evaluation metrics Hold a consensus-building meeting
IV	Evaluate Candidate Standards	<ul style="list-style-type: none"> Conduct an interactive set of evaluations with the SME Panel and developers
V	Host Meeting	<ul style="list-style-type: none"> Hold a consensus-building meeting for Stakeholders to share information
VI	Derive and Execute Test Cases	<ul style="list-style-type: none"> Involve users and Stakeholders in the development of scenario-based test cases and execute the tests for the identified candidate standards (where applicable)
VII	Develop Recommendations and Evaluate Process	<ul style="list-style-type: none"> Produce a report that recommends standards for PCO considerations as the basis for MHS Blast Injury Prevention Standards Recommend improvements to the BIPSR Process

Figure 3: BIPSR Process Pillar Activities

For additional information on BIPSR Process Blast Injuries, please visit MHSRS-19-00321 – Session 1 – #325 for Auditory Blast Injury and MHSRS-19-02048 – Session 1 - #587 for Skull Fracture Blast Injury.



BIPSR Process Ocular Blast Injury Type Candidate Standard and Ballistic Eyewear consideration in the mechanical response of structural tissues of the eye to blast exposure.



Results and Discussion

- A preliminary literature review indicated that the predominant mechanism of ocular injury occurring during combat is penetrating fragments from explosions (secondary blast injuries). Secondary blast effects from propelled explosive foreign bodies can result in laceration, abrasion, or rupture of the globe. Tertiary blast effects from direct blunt force to the eye, the orbit, and surrounding tissues often results in concomitant head and facial injuries. Less common findings to-date are primary ocular blast injuries as a result of the blast shockwave making contact with the surface of the eye and surrounding tissues.
- Guidance reviewed include the Military Performance Specification MIL-PRF-32432A, which requires ballistic eyewear to protect against dust, flying debris, and ballistic hazards both in training and on the battlefield, and the Military Ballistic Standards (American National Standards Institute Z87.1 and V50), which include specifications for high-velocity impact testing for spectacles (prescription and nonprescription) and goggles.
- Eyewear authorized for military combat is required to withstand rigorous impact testing. BIPSR Process DoD Stakeholders may want to consider how current requirements evaluate fragments traveling at great velocities and the impact force of fragments at a close range, as seen with modern weapon systems. Stakeholders may also be interested in additional research on the effects of primary ocular blast injury.

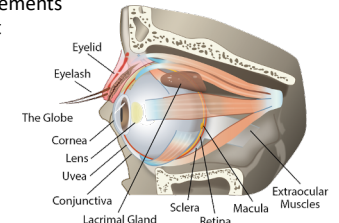


Figure 3: Basic Anatomy of the Human Eye.



Figure 4: Injury Mechanisms from Blasts.

Conclusion

- While current Ballistic Eyewear Standards provide guidance on protection against shrapnel and ballistic threats, existing criteria reviewed as a part of this initial literature review indicate that guidance focuses on managing threats, rather than injury prediction. BIPSR Process Stakeholders may want to consider tissue tolerances to blast exposure and the mechanical response of ocular structural tissue.

Disclosure

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