



# EMESRT

Earth Moving Equipment Safety Round Table

## DESIGN PHILOSOPHY 6: HEALTH IMPACTING FACTORS



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### Objective

The objective is to prevent harm from exposure to health impacting factors to as low as reasonably practical, including consideration in design for foreseeable human error.



### General outcome

The intended design outcome should include/consider: Engineered controls, which under all operational and environmental conditions, will eliminate or minimise exposure to:

- Airborne hazards, including harmful particulates, gases and vapours produced by or generated by the equipment
- Noise generated by the equipment [and that is not easily damaged or degraded]
- Whole-body and hand-arm vibration, under all operational and environmental conditions including range of body dynamics and exposure frequency
- Musculoskeletal hazards for all anthropometric body types

Where elimination cannot be achieved, the design should prevent exposure, under all operational and environmental conditions, to:

- Airborne hazards, including harmful particulates, gases and vapours produced by or generated by the equipment that cause harm to people
- Noise levels that cause harm to people
- Whole-body and hand-arm vibration greater than those recommended by occupational standards

The intended design outcome should also include the ability to warn the operator that design limits have been exceeded.

**NOTE:** Airborne hazards include, but are not limited to, particulates (DPM, fibres, respirable dust, inhalable dust, silica, inspirable dust, etc), gases (nitrous oxides, sulphides, carbon monoxide, carbon dioxide, etc) and vapours (oil droplets, steam containing hazardous substances, etc).



## Causal Pathways

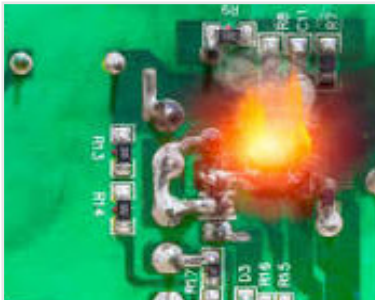
### 6.1 Harm from exposure to health hazards such as:

- Extreme temperatures
  - Inadequate or no climate control
- Excessive vibration and noise levels
  - Inadequate attenuation and restraint systems
- Particulates, gases, and vapours within the operating workspace due to:
  - Open windows/doors
  - Inadequate window/door seals
- Musculoskeletal hazards due to inadequate ergonomic and anthropometric range in the design of equipment and controls



### 6.2 Harm due to failure of equipment control systems, such as:

- Electronic systems
  - Computer systems
  - Equipment controls
- being damaged (bridging, abrasion, etc.) by particulates, gases, or vapours



### 6.3 Harm from inadvertent exposure to health hazards, including:

- Unacceptable output of particulates, gases, and vapours
- Fibrous material generated in brake and other lining materials
- Excessive levels of noise
- Excessive vibration due to operators not being aware of deterioration of equipment, such as uncaptured machine degradation, design limits or conditions



**6.4** Harm from noise levels that induce hearing loss, mental and/or physical fatigue for personnel in the workshop and other working environments due to maintenance activities associated with the equipment.



**6.5** Harm caused by distraction and/or impaired ability to hear audible warnings or alarms (e.g horns, directional reversing alarms) due to:

- Excessive and/or high impact noise levels generated by equipment
- Excessive levels of spectator noise penetrating the operator workspace



**6.6** Acute or cumulative musculoskeletal harm, adverse health effects to body organs and increased levels of fatigue from excessive levels of whole-body vibration, especially in conjunction with sustained and/or awkward postures, due to inadequate ergonomic design of equipment.

