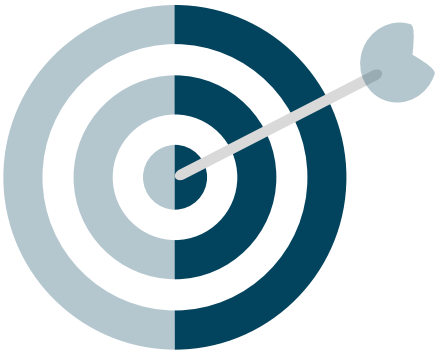
EMESRT

Earth Moving Equipment Safety Round Table

DESIGN PHILOSOPHY 4

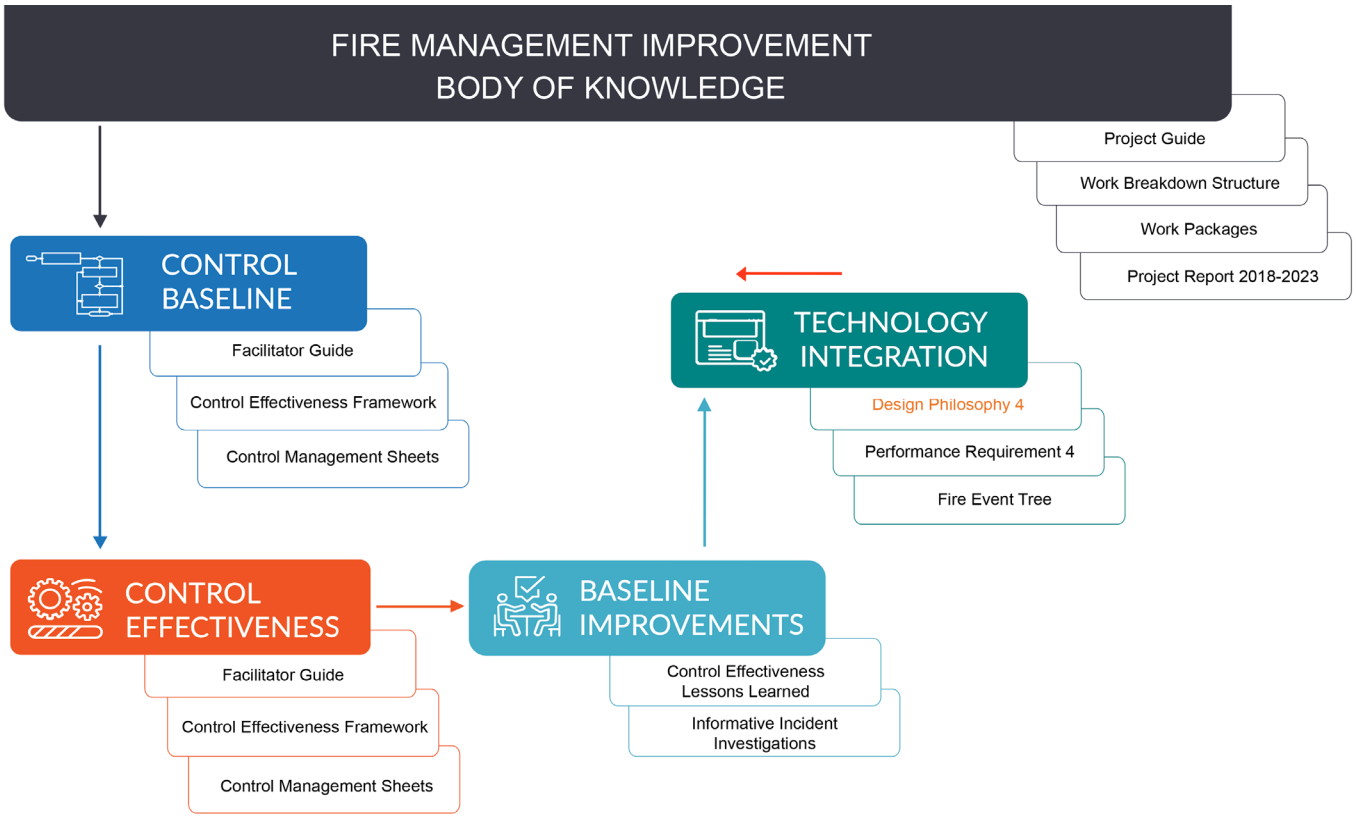
FIRE



Objective

The objective of Design Philosophy 4 (DP-4) is to prevent harm related to equipment fires to as low as reasonably practical, including consideration in design for foreseeable human error.

The diagram below provides an understanding of where the Design Philosophy 4 integrates into the overall Fire Management Improvement Body of Knowledge industry resources.



General outcome

The intended design outcome should include/consider the following:

- Elimination of ignition type of fuel sources
- Early fire detection and appropriate response initiation
- Protection of the operator should fire occur
- Automatic suppression of fire - design
- Automatic engine shutdown and isolation of fuel sources, should fire occur
- Manual suppression of the fire should auto suppression be inadequate

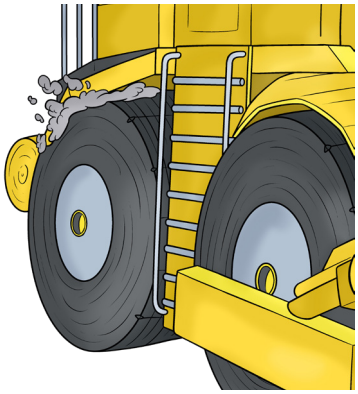
4.1 Causal Pathways

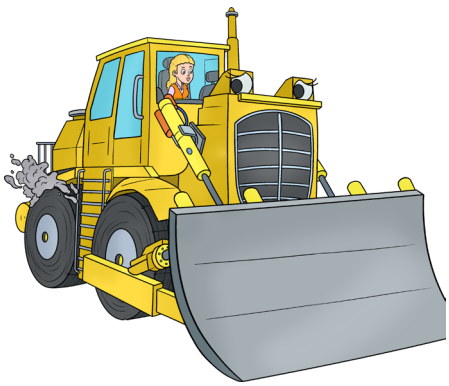
Harm from fire arising from damage (including heating, melting, and chaffing) to electrical cables and components; hydraulic hoses; and fuel lines due to design inadequacies including:

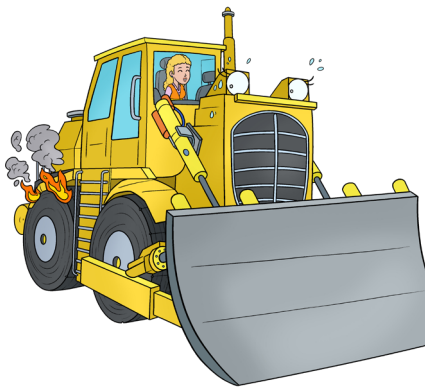
- Inadequate location and or routing
- Inadequate separation of fuel and ignition sources, i.e. turbo, exhaust systems
- Flaws in clamping or restraint

4.2 Causal Pathways

Harm from fire arising from heat generated by surface frictions (including tyres).







4.3 Causal Pathways

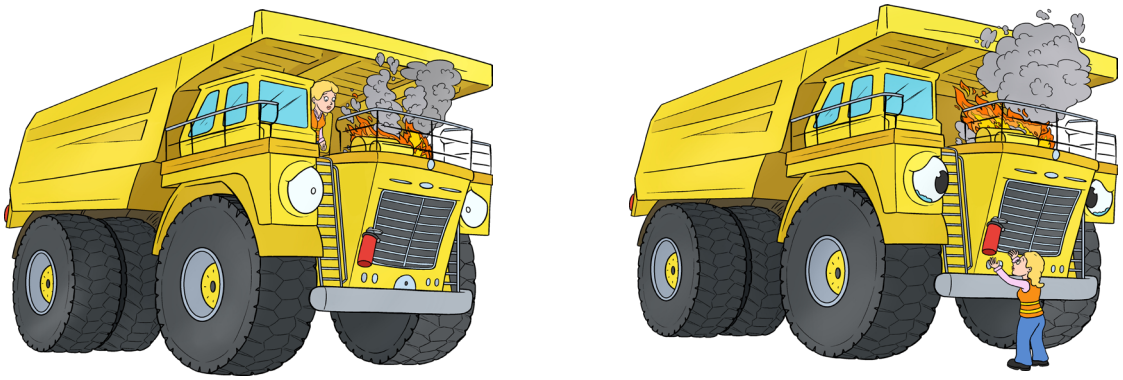
Harm from fire igniting in, or being propagated by, the buildup of combustible material e.g., dirt, oily rags.

4.4 Causal Pathways

Harm from entrapment in the cabin due to fire blocking normal and emergency egress.

4.5 Causal Pathways

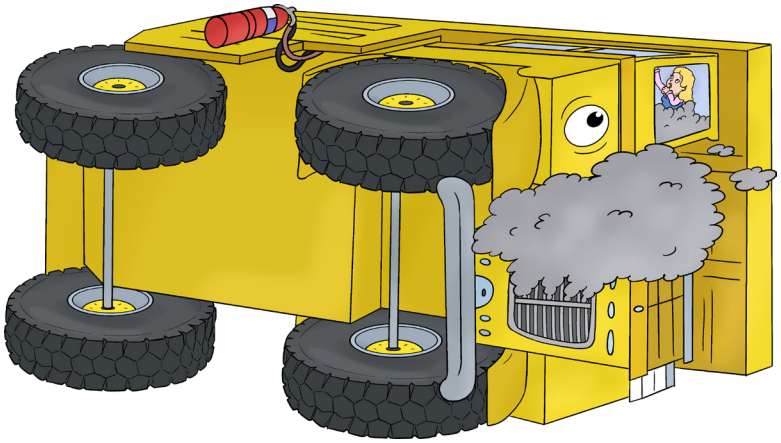
Harm from entry into hazard zones due to the location of isolation points for fuel sources.



4.6 Causal Pathways

Harm to personnel, either during normal operation or in the event of a roll over or other accident, from inhalation, ingestion, skin abrasion, slips, trips or other mechanism due to:

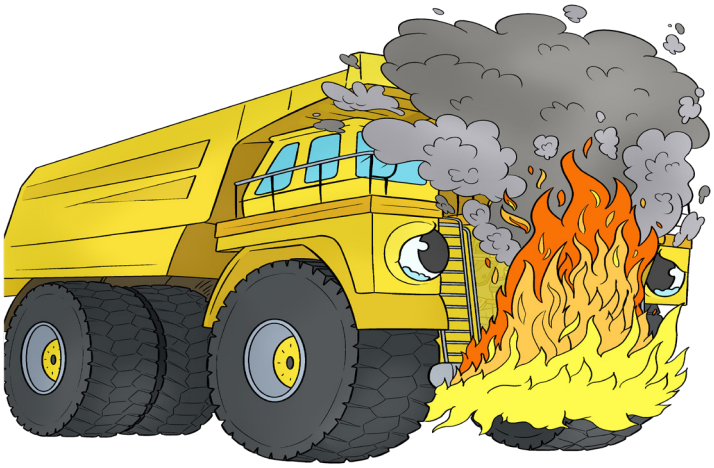
- Fire Suppression System components that are inadequately located
- Accidental actuation of the Fire Suppression System



4.7 Causal Pathways

Harm from excessive/uncontrolled spread of fire, due to:

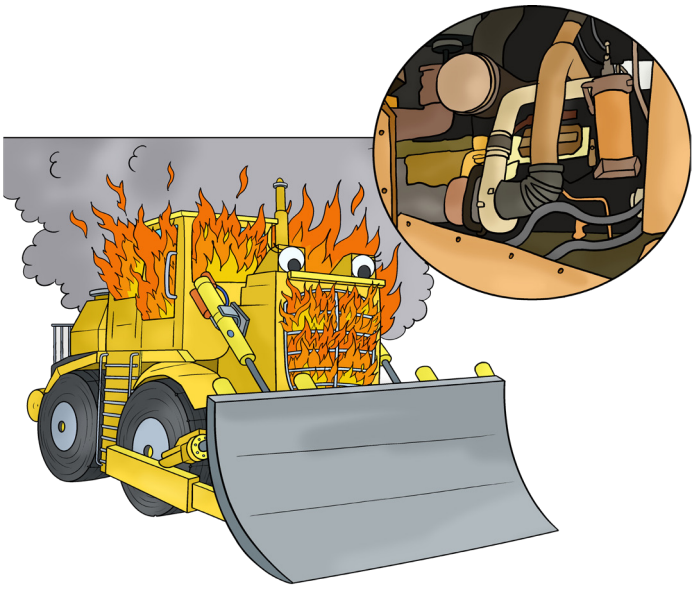
- Lack of automatic engine shutdown and/or isolation of fuel sources
- Failure of the Fire Suppression System to activate due to the effects of fire, maintenance and/or other damage
- Delayed activation of Fire Suppression System due to difficult access to Fire Suppression System controls
- Reduced effectiveness of Fire Suppression System as a result of additional fitted options, such as noise suppression blankets
- Ineffective fire suppression design or installation
- Ineffective fire suppression agent to suppress the fire type, e.g. chemical



4.8 Causal Pathways

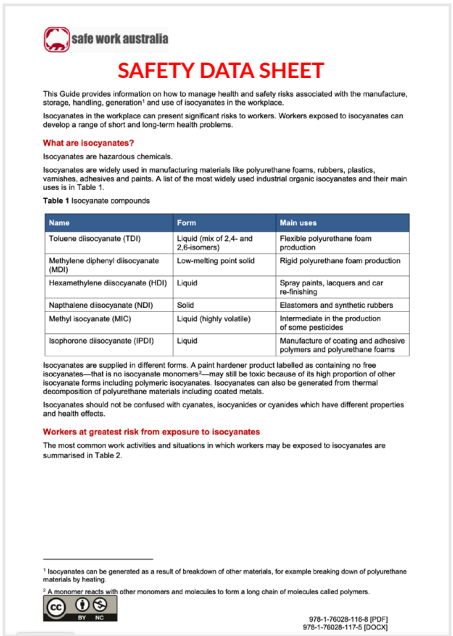
Design, that fails to adequately separate heat and fuel sources, i.e., rubber rather than fixed steel hydraulic fuel sources routed in engine bay, tyres inadequately shielded from heat sources

- Inadequate engine ventilation design that directs air from fuel sources across heat sources
- Inadequate design of firewall and bulkhead sealing to prevent spread of fire
- The use of construction materials that fuel a fire, i.e., flammable engine covers and mudguards



4.9 Causal Pathways

Emergency response and recovery - In the event of an incident, emergency response teams require information on the potential hazards and actions they could take to prevent the fire event from escalating, e.g. safety data sheet on a particular chemical used on site, etc.



safe work australia

SAFETY DATA SHEET

This Guide provides information on how to manage health and safety risks associated with the manufacture, storage, handling, generation[1] and use of isocyanates in the workplace.

Isocyanates in the workplace can present significant risks to workers. Workers exposed to isocyanates can develop a range of short and long-term health problems.

What are isocyanates?

Isocyanates are hazardous chemicals.

Isocyanates are widely used in manufacturing materials like polyurethane foams, rubbers, plastics, varnishes, adhesives and paints. A list of the most widely used industrial organic isocyanates and their main uses is in Table 1.

Table 1 Isocyanate compounds

Name	Form	Main uses
Toluene diisocyanate (TDI)	Liquid (mix of 2,4- and 2,6-isomers)	Flexible polyurethane foam production
Methylene diphenyl diisocyanate (MDI)	Low-melting point solid	Rigid polyurethane foam production
Hexamethylene diisocyanate (HDI)	Liquid	Spray paints, lacquers and car re-finishing
Naphthalene diisocyanate (NDI)	Solid	Elastomers and synthetic rubbers
Methyl isocyanate (MIC)	Liquid (highly volatile)	Intermediate in the production of some pesticides
Isophorone diisocyanate (IPDI)	Liquid	Manufacture of coating and adhesive polymers and polyurethane foams

Isocyanates are supplied in different forms. A paint hardener product labelled as containing no free isocyanates—that is no isocyanate monomers[2]—may still be toxic because of its high proportion of other isocyanate forms including polymeric isocyanates. Isocyanates can also be generated from thermal decomposition of polyurethane materials including coated metals.

Isocyanates should not be confused with cyanates, isocyanides or cyanides which have different properties and health effects.

Workers at greatest risk from exposure to isocyanates

The most common work activities and situations in which workers may be exposed to isocyanates are summarised in Table 2.

[1] Isocyanates can be generated as a result of breakdown of other materials, for example breaking down of polyurethane materials by heating.

[2] A monomer reacts with other monomers and molecules to form a long chain of molecules called polymers.

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