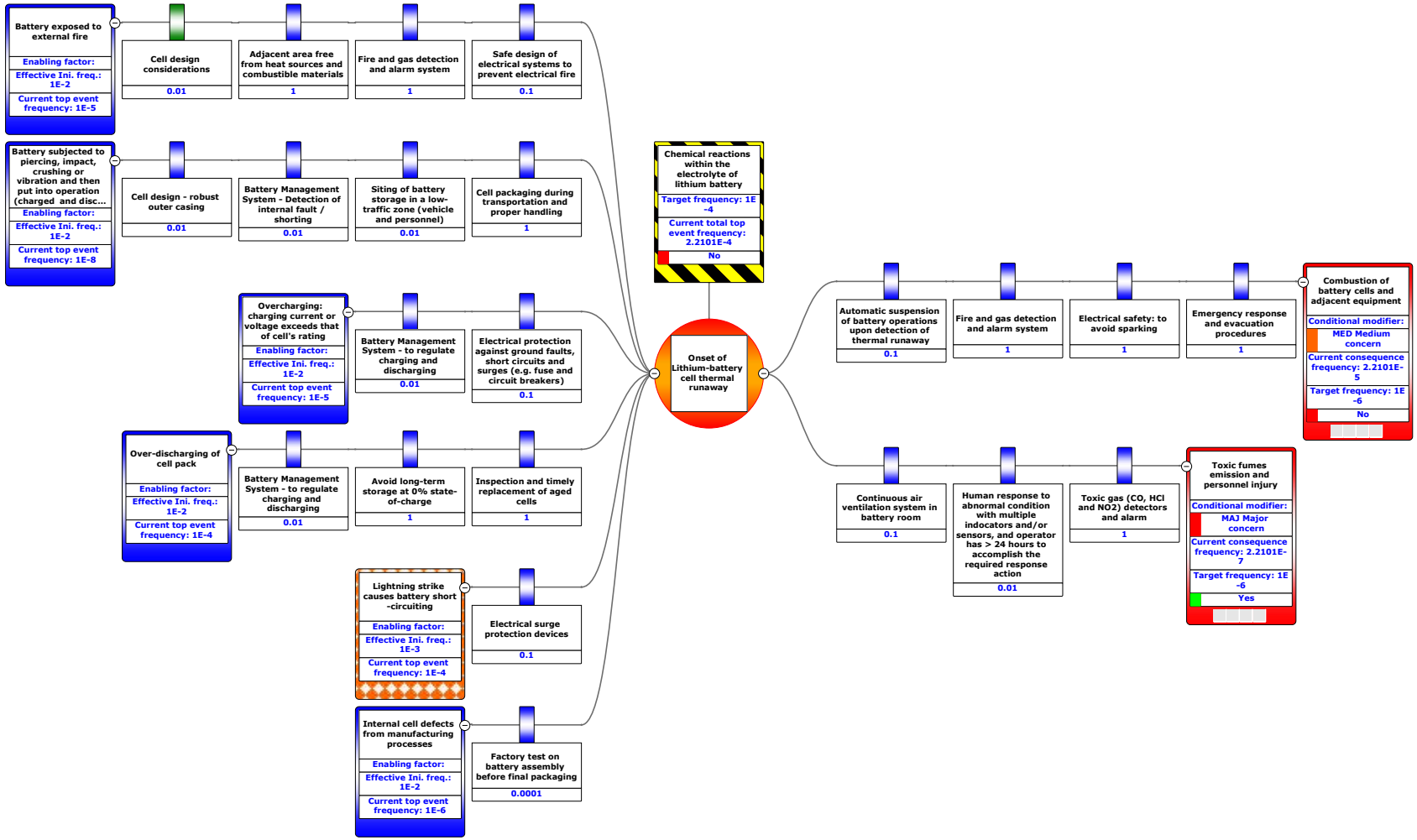
Battery exposed to external fire
Enabling factor:
Effective Ini. freq.: 1E-2
Current top event frequency: 1E-5
Cell design considerations
0.01
Adjacent area free from heat sources and combustible materials
1
Fire and gas detection and alarm system
1
Safe design of electrical systems to prevent electrical fire
0.1
Battery subjected to piercing, impact, crushing or vibration and then put into operation (charged and disc...
Enabling factor:
Effective Ini. freq.: 1E-2
Current top event frequency: 1E-8
Cell design - robust outer casing
0.01
Battery Management System - Detection of internal fault / shorting
0.01
Siting of battery storage in a low-traffic zone (vehicle and personnel)
0.01
Cell packaging during transportation and proper handling
1
Overcharging: charging current or voltage exceeds that of cell's rating
Enabling factor:
Effective Ini. freq.: 1E-2
Current top event frequency: 1E-5
Battery Management System - to regulate charging and discharging
0.01
Electrical protection against ground faults, short circuits and surges (e.g. fuse and circuit breakers)
0.1
Over-discharging of cell pack
Enabling factor:
Effective Ini. freq.: 1E-2
Current top event frequency: 1E-4
Battery Management System - to regulate charging and discharging
0.01
Avoid long-term storage at 0% state-of-charge
1
Inspection and timely replacement of aged cells
1
Lightning strike causes battery short -circuiting
Enabling factor:
Effective Ini. freq.: 1E-3
Current top event frequency: 1E-4
Electrical surge protection devices
0.1
Internal cell defects from manufacturing processes
Enabling factor:
Effective Ini. freq.: 1E-2
Current top event frequency: 1E-6
Factory test on battery assembly before final packaging
0.0001
Chemical reactions within the electrolyte of lithium battery
Target frequency: 1E-4
Current total top event frequency: 2.2101E-4
No
Onset of Lithium-battery cell thermal runaway
Automatic suspension of battery operations upon detection of thermal runaway
0.1
Fire and gas detection and alarm system
1
Electrical safety: to avoid sparking
1
Emergency response and evacuation procedures
1
Combustion of battery cells and adjacent equipment
Conditional modifier:
MED Medium concern
Current consequence frequency: 2.2101E-5
Target frequency: 1E-6
No
Continuous air ventilation system in battery room
0.1
Human response to abnormal condition with multiple indocators and/or sensors, and operator has > 24 hours to accomplish the required response action
0.01
Toxic gas (CO, HCl and NO2) detectors and alarm
1
Toxic fumes emission and personnel injury
Conditional modifier:
MAJ Major concern
Current consequence frequency: 2.2101E-7
Target frequency: 1E-6
Yes