

# PMSafety Consultants Ltd.

## Fault and Event Tree Analysis

“A Systems Assurance tool to allow the quantification of risk.”

### FAULT TREES



PMSC Limited provides Systems Assurance advice to a wide range of customers both in the UK and Internationally.

### EVENT TREES



We employ various Systems Assurance tools and technologies to be able to quantify risks to critical exposed groups. One such modelling technique is Fault and Event Tree Analysis (FTA/ETA)

### QUANTIFIED RISK ANALYSIS



The procedure when developing FTA/ETA is to firstly define the system boundary being considered and the top event to be modelled. Any assumptions are also recorded to simplify the model or to define any limitations which might be applicable.

### BOOLEAN ALGEBRA



The event trees model a sequence of events from an initiating event through various nodes until end states are reached at which point consequences are assigned, usually from predetermined bounding consequence groups. For consistency, consequences should always be applied to end states using a predefined rule set. The event tree may have certain nodes which reflect whether safeguards systems work or fail in the event sequence. The failure of such systems can be modelled using Fault Tree models which are derived from the use of Boolean algebra symbols and logic models based on probability theory.

### SYSTEM BOUNDARY



### FAULT TREE +



Our experienced advisors have performed many FTA/ETA analyses across a range of problems and industries using the Fault Tree + Software from Isograph Direct ([www.isograph.com](http://www.isograph.com))

Please see over page for examples of FTA/ETA studies successfully completed by PMSC.





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## Fault and Event Tree Analysis

### Fault and Event Tree Analysis Work Undertaken by PMSC

#### KAWASAKI

PMSC prepared a detailed fully integrated Quantified Risk Analysis for the C751B train in Singapore.

#### ITOCHU, KAWASAKI, KINKI SHARYO

PMSC prepared a detailed fully integrated Quantified Risk Analysis for the SP1900 train in Hong Kong.

#### KAWASAKI, ITOCHU, TOSHIBA (KIT)

Outline Fault Tree analysis was prepared for the Systems Safety Plan for the Marina Line Extension project bid.

#### KAWASAKI

An integrated Fault and Event Tree model was constructed to model the risk arising from fire scenarios on a high-speed train service in Taiwan.

#### SINGAPORE LAND TRANSPORT AUTHOR-

PMSC delivered a systems assurance course, part of which had a module solely on the application of Fault Tree Analysis.

#### INCO

PMSC developed a Fault Tree model to model a predetermined top event for a nickel foam plant. The model was used to predict the unavailability of the plant and provide feedback to the management of ways to improve availability

#### NUCLEAR INSTALLATIONS INSPECTORATE

PMSC coordinated the development of an integrated Fault Tree analysis including Human Error and Common Cause Failure considerations for the over side services at 9 Dock.

#### NUCLEAR INSTALLATIONS INSPECTORATE

Fault and Event Tree analysis was independently constructed for the 80 Te Crane at DML.

#### BRITISH ENERGY

A detailed Fault Tree analysis of the Carbon Dioxide cooling system for the on-load refuelling machine at Heysham II was conducted to demonstrate that the plant met the requirements placed on the operation by the Nuclear Installations Inspectorate

#### BRITISH GAS EXPLORATION

A generic QRA Fault & Event Tree model was developed for a generic Platform in the North Sea to assess the risk of premature fatality to workers as a result of the platform operations. A number of initiating events were assessed and British Gas failure event data used to be able to make predictions. The model was developed in a generic way such that several configurations of protection systems were modelled in fault tree logic.



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#### SCOTT WILSON RAILWAYS

A series of Fault Trees were developed for a selection of different configurations of signalling power systems. The Fault Tree model was used to make recommendations as to the optimal configuration for the system to maximise the availability of power supplies and minimise the interruptions to signalling of trains on an operational railway.