

# 1 Problem

<b>What</b>	Problem(s)	Tank overflow, explosion and fire, contamination of groundwater
<b>When</b>	Date	December 11, 2005
	Time	5:37 AM
<b>Where</b>	Different, unusual, unique	No wind
	Facility, site	Buncefield Oil Storage Depot, Hemel Hempstead, Hertfordshire
	Unit, area, equipment	Hertfordshire Oil Storage East - Tank 912
	Task being performed	Receiving unleaded petrol from UKOP South line

## Impact to the Goals

<b>Safety</b>	43 injuries, potential for fatalities
<b>Environmental</b>	Contamination of ground water
<b>Cust. Service</b>	Disrupted fuel supply to Heathrow Airport
<b>Production-Schedule</b>	Significant loss in production
<b>Property, Equip, Mtls</b>	Majority of the site was destroyed and significant damage to neighboring properties
<b>Labor, Time</b>	Emergency reponse, repair, clean-up, compensation and investigation

# BUNCEFIELD STORAGE DEPOT EXPLOSION CAUSE MAP

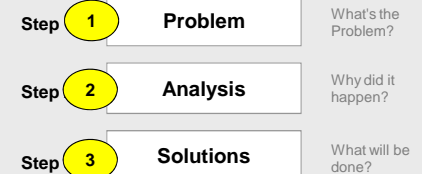
43 employees were injured and significant damage occurred at the Buncefield Storage Depot and neighboring properties when a large butane vapor cloud explosively ignited. The vapor cloud was a result of a tank overflowing during a normal receipt of winter grade petrol, which contains 10% butane. During the incident, the diked wall area around the tank did not contain the hydrocarbon and fire suppression foam as designed, and the local groundwater table was contaminated. The estimated total financial impact of the incident was over \$1 Billion.



Cause Mapping is a Root Cause Analysis method that captures basic cause-and-effect relationships supported with evidence.

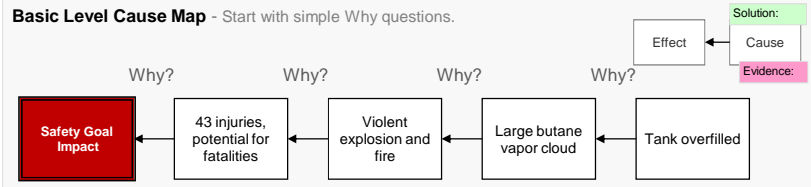
## CAUSE MAPPING

Problem Solving • Incident Investigation • Root Cause Analysis



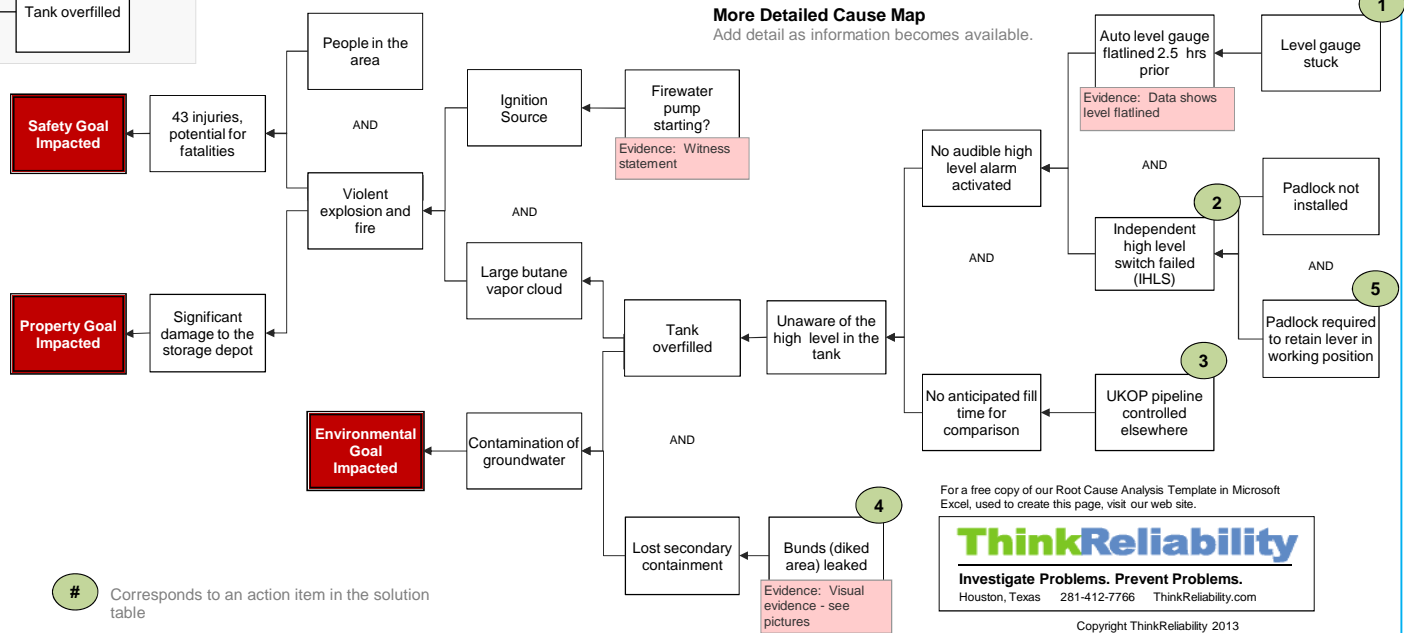
# 2 Analysis

Basic Level Cause Map - Start with simple Why questions.



# 3 Solutions

No.	Action Item	Cause
1	Develop a methodology to determine safety integrity level requirements for overflow prevention systems	Level gauge stuck
2	Establish a high integrity, automatic operating overflow prevention system that is separate and independent from the tank gauging system	Independent high level switch failed (IHLS)
3	The sector should put in place arrangements to ensure the receiving site has ultimate control of tank filling	UKOP pipeline is controlled from elsewhere
4	Review existing standards for secondary and tertiary containment	Bunds (diked area) leaked
5	Modify design to incorporate a pin to prevent the handle from traveling below the horizontal working position	Padlock required to retain lever in working position



For a free copy of our Root Cause Analysis Template in Microsoft Excel, used to create this page, visit our web site.

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