


# SAN BRUNO EXPLOSION


## Timeline & Process Map

When Line 132 ruptured last September in the community of San Bruno, California, emergency personnel were quick to respond to the natural gas explosion. The first fire truck was on scene within six minutes of the explosion. What responders found was a chaotic scene, with multiple wounded and killed and swaths of the neighborhood in flames or simply flattened. Little did they know that a large natural gas transmission line, feeding the spreading fire, was directly beneath them. Emergency personnel did their best to clear homes and evacuate the wounded as the fire spread, but the confusion continued for nearly 90 minutes until the gas valves were shut off upstream from the fire.

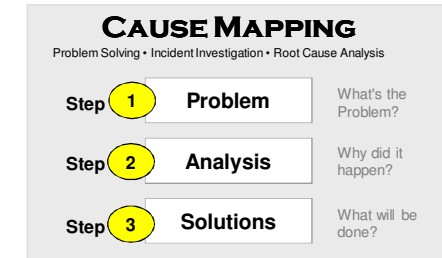
"Because of the strong safety record of these pipelines and the fact that they're typically underground, most people don't even know that they exist. Therefore, it is all the more important that pipeline operators and those responsible for regulating them make sure the nation's pipeline system is as safe as possible."  
 - NTSB Investigation Chairman Deborah Hersman

**Timelines** - Timelines can help build more complete and accurate Cause Maps and process maps by sequencing events and identifying problems.

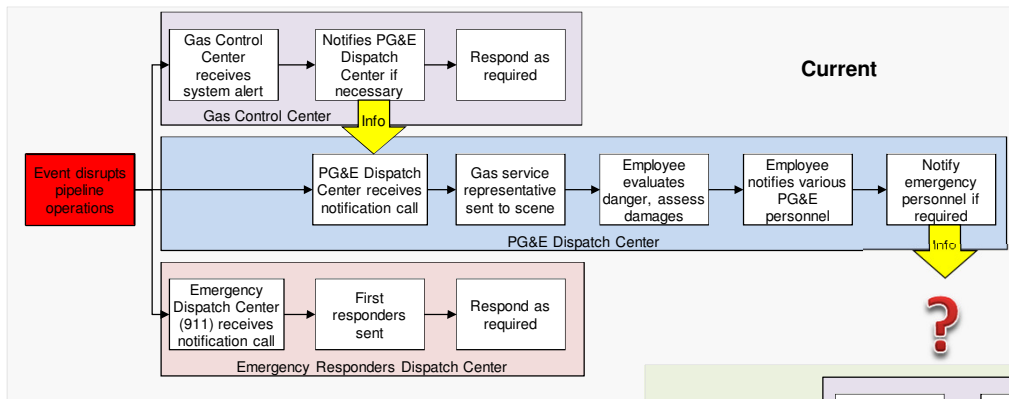
PG&E Events		
Date	Time	Description
September 9, 2010	6:11 PM	Explosion occurs 
	+ 4 minutes	Gas Control system alarms at PG&E Gas Control Center after pressure drop
	+ 7 minutes	Call-in from off-duty employee to PG&E Dispatch Center
	+ 11 minutes	Call-in from off-duty employee to PG&E Dispatch Center
	+ 12 minutes	Dispatch Center sends gas service representative to confirm situation
	+ 16 minutes	Dispatch Center notifies Gas Control Center about fire and general location of explosion
	+ 20 minutes	Gas Control Center speculates line might be involved in fire
	+ 79 minutes	Two employees shut off first upstream valve
	+ 94 minutes	Two employees shut off second and third upstream valves

911 Events		
Date	Time	Description
September 9, 2010	6:11 PM	Explosion occurs 
	+ 1 minutes	911 Call
	+ 6 minutes	First responders arrive at scene

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



## Process Maps

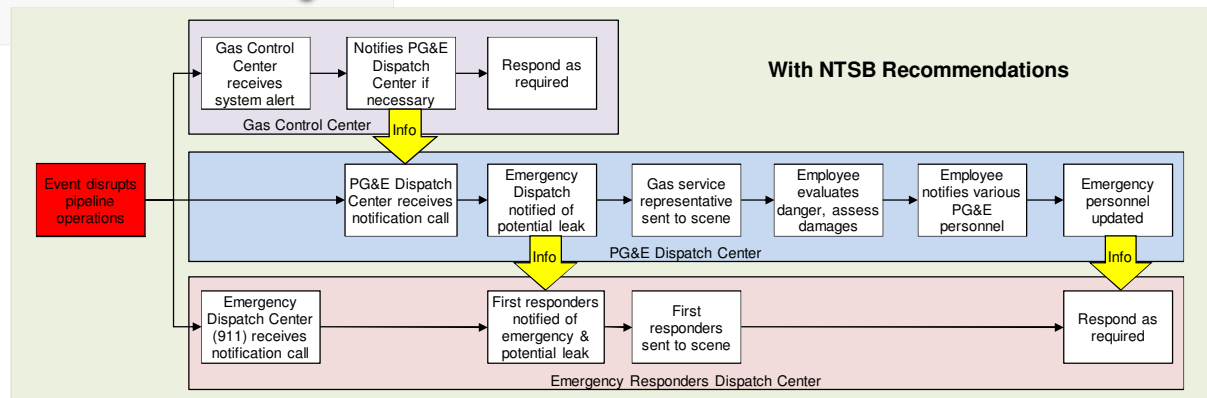


## Tying Process Maps, Timelines and Cause Maps Together

When conducting an investigation, a timeline can be a helpful tool to organize information. While straightforward to build, timelines can identify areas needing more research and aid in building a process map and a Cause Map. Compare what happened at PG&E to what emergency responders were doing. You'll notice there was a significant delay at PG&E in recognizing there was a problem and then acting upon it. It took nearly 90 minutes to close valves to shut transmission lines. Changes must be made to speed up PG&E's procedures in a crisis situation.

Likewise process maps are a useful tool for determining where a process can use improvement. In the Current process map, it is noticeable that there are three parallel processes occurring, where information is not being shared in an efficient manner. The PG&E Dispatch Center only shares information with the Emergency Dispatch Center after they have fully assessed the situation. This information might come after the fact, as it did in San Bruno, or seriously delay an effective response by EMTs and firefighters. Going one step further, trained emergency personnel might be able to check with local utilities if they have reason to suspect a natural gas pipeline is involved. Simple procedural changes, such as who is notified and when, can have significant impacts.

It is important to note that the timeline helps create the most accurate "As Occurred" process map (called Current in this case). Procedures can differ from actual processes, so it is important to document what actually happened, identify differences in what should have occurred, and figure out why it didn't. In this case, PG&E's procedures were followed and need to be revised.



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

