

Incident Summary #II-1490880-2023 (#30925) (FINAL)

SUPPORTING INFORMATION	Incident Date	January 7, 2023	
	Location	Richmond	
	Regulated industry sector	Gas - Natural gas system	
	Impact	Qty injuries	0
		Injury description	No reported injuries
		Injury rating	None
	Damage	Damage description	Natural gas leaked from a cement kiln and ignited in a fireball.
		Damage rating	Minor
Incident rating	Minor		
Incident overview	A removable pilot is used to ignite the main burner of a large cement kiln. The automatic pilot was damaged and stopped working. While attempting to manually operate the pilot with bypassed safety switches, gas leaked from an opening where a safety sensor was removed and ignited in a fireball.		
INVESTIGATION CONCLUSIONS	Site, system, and components	<p>The facility uses a large kiln to produce cement products that has been in operation since 1999. The kiln has a 200,000,000 btu natural gas fired burner system to produce the high heat needed for the kiln. When the kiln is operating it can also be supplied with additional solid fuels to aid in the heat production. The main gas burner for the kiln is ignited by a 200,000 btu natural gas pilot burner system that was approved and installed in 2019.</p> <p>The pilot burner consists of a stainless-steel tube, approximately 15 feet long, containing a gas pipe to a gas burner located at the end of the tube. The pilot assembly is on a rail that allows the long pilot tube to be inserted into the kiln when it is required to be used. When the main burner is in operation, the pilot tube assembly can be retracted out of the kiln to protect it from damage due to the high heat produced inside the kiln. For the pilot assembly to operate there is a proximity safety switch that closes when the pilot assembly is fully inserted into the kiln. The pilot assembly will not operate unless the proximity switch is closed. When the pilot burner is energized, the gas is ignited by a spark ignitor and is monitored by a flame scanner sensor at the beginning of the tube. The main gas burner safety valves will not open unless a pilot flame is sensed by the scanner.</p>	
	Failure scenario(s)	<p>At some point prior to the incident, the pilot assembly was likely exposed to high temperatures in the kiln that damaged the assembly. The wiring and spark ignitor for the burner were damaged from the heat and the tube had warped which obscured the sight of the pilot flame from the flame scanner safety switch. Due to this damage, the pilot assembly would not ignite or remain lit if there was a pilot flame.</p> <p>To get the pilot burner to operate, workers at the facility retracted the pilot tube from the kiln, bypassed the proximity safety switch that was used to prove the pilot tube was fully inserted into the kiln, manually ignited the pilot burner while it was retracted from the kiln, and held a flame in front of the flame scanner assembly which had been removed from the pilot tube assembly to fool the scanner and allow the pilot gas valves to continue flowing gas. The workers then began inserting the pilot tube</p>	

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	<p>into the kiln which caused an unburnt gas/air mixture in the tube to escape the opening from where the flame scanner was removed. The escaping gas likely was ignited by the flame that was being used to fool the flame scanner sensor causing a fireball.</p>
<p>Facts and evidence</p>	<p>Worker statements</p> <ul style="list-style-type: none"> • The kiln burners and ignition system are monitored from the control room. • The main kiln burner ignition sequence includes the introduction into the kiln of a removable pilot assembly. • Cameras provide the control room operators with a view of the workers while they manually introducing the pilot assembly into the kiln to ignite the main burner. • The wires and the ignitor for the pilot burner had been damaged and the pilot burner had to be ignited manually. • The pilot burner scanner was unable to see or sense that the pilot burner was lit. It was determined to remove the pilot flame scanner from the pilot burner assembly and hold a flame in front of the scanner so that the main burner could be lit. • Gas escaped through the open scanner position hole and ignited. • The attempt to ignite the main burner was discontinued until the pilot burner assembly was repaired.
<p>Causes and contributing factors</p>	<p>It is highly likely that the incident was caused by the manual operation of the pilot burner while it was retracted from the kiln with the safety circuits defeated and an opening left where the flame scanner was removed.</p>

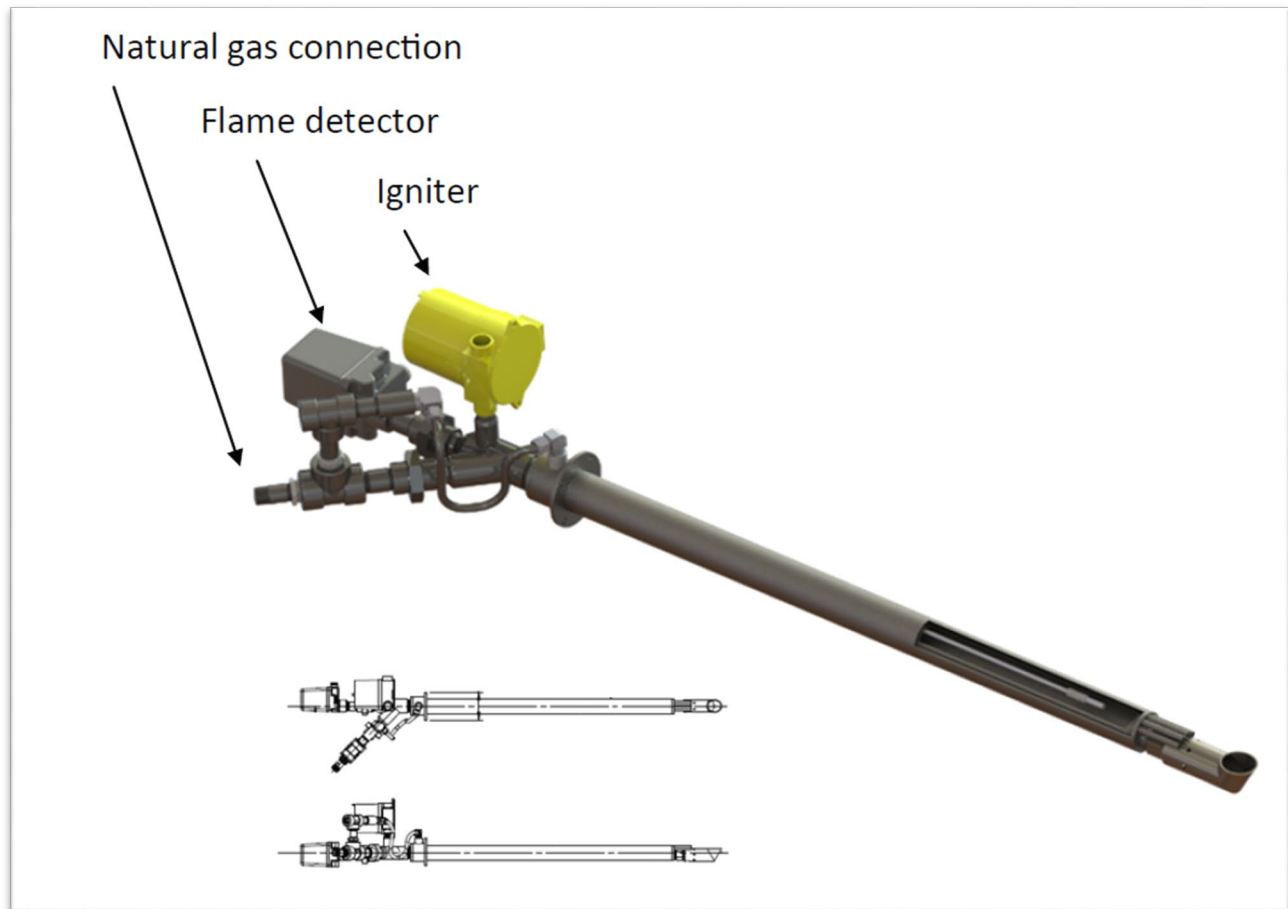


Photo 1 – Example of a similar pilot assembly from manufacturer brochure showing a shorter tube, igniter, flame scanner and gas connection.

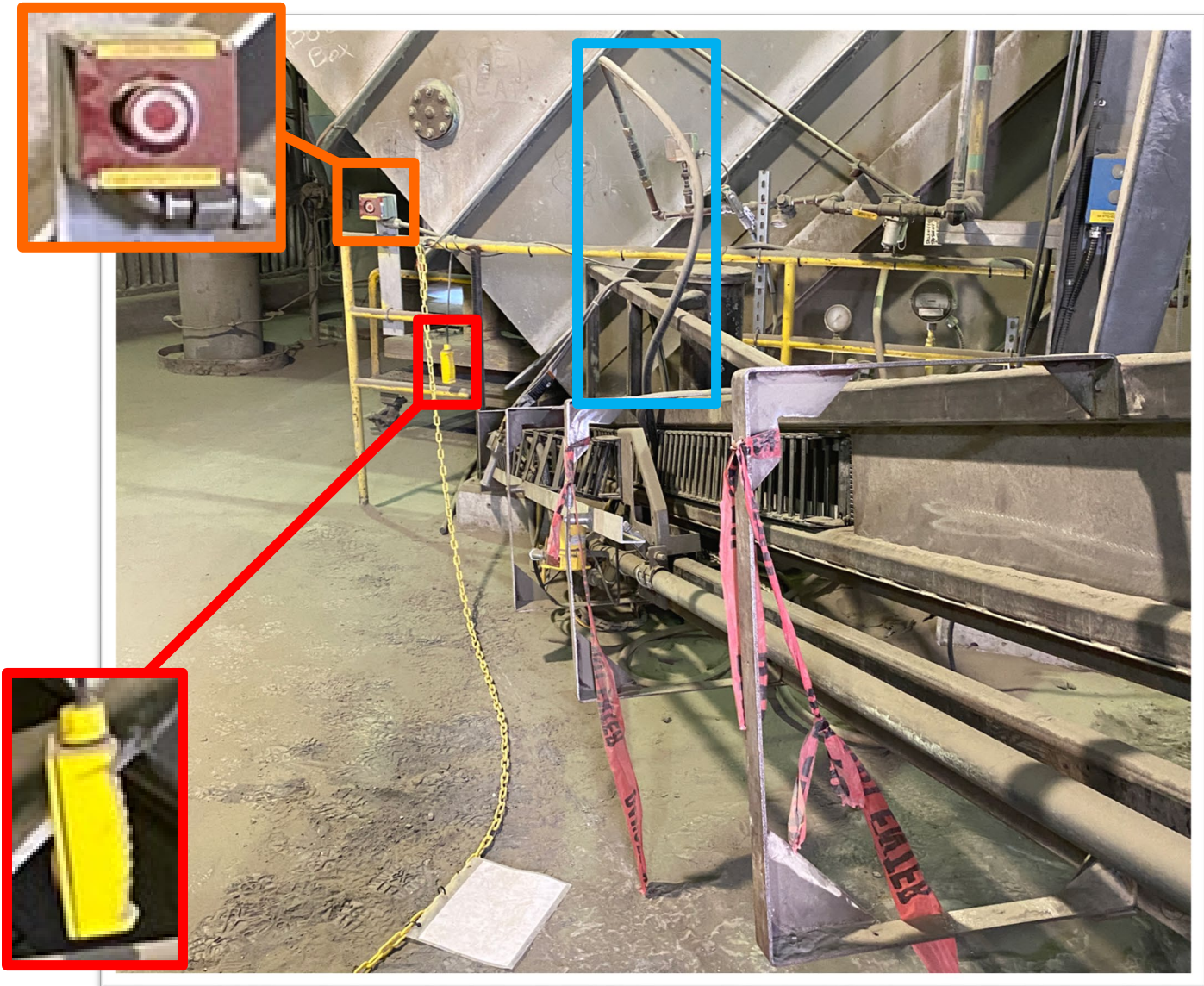


Photo 2 (Photo taken before incident) – Pilot tube assembly on retractable rail. **BLUE** - the pilot gas line. **RED** - the controller for moving the pilot tube in and out of the kiln. **ORANGE** - the emergency stop button.

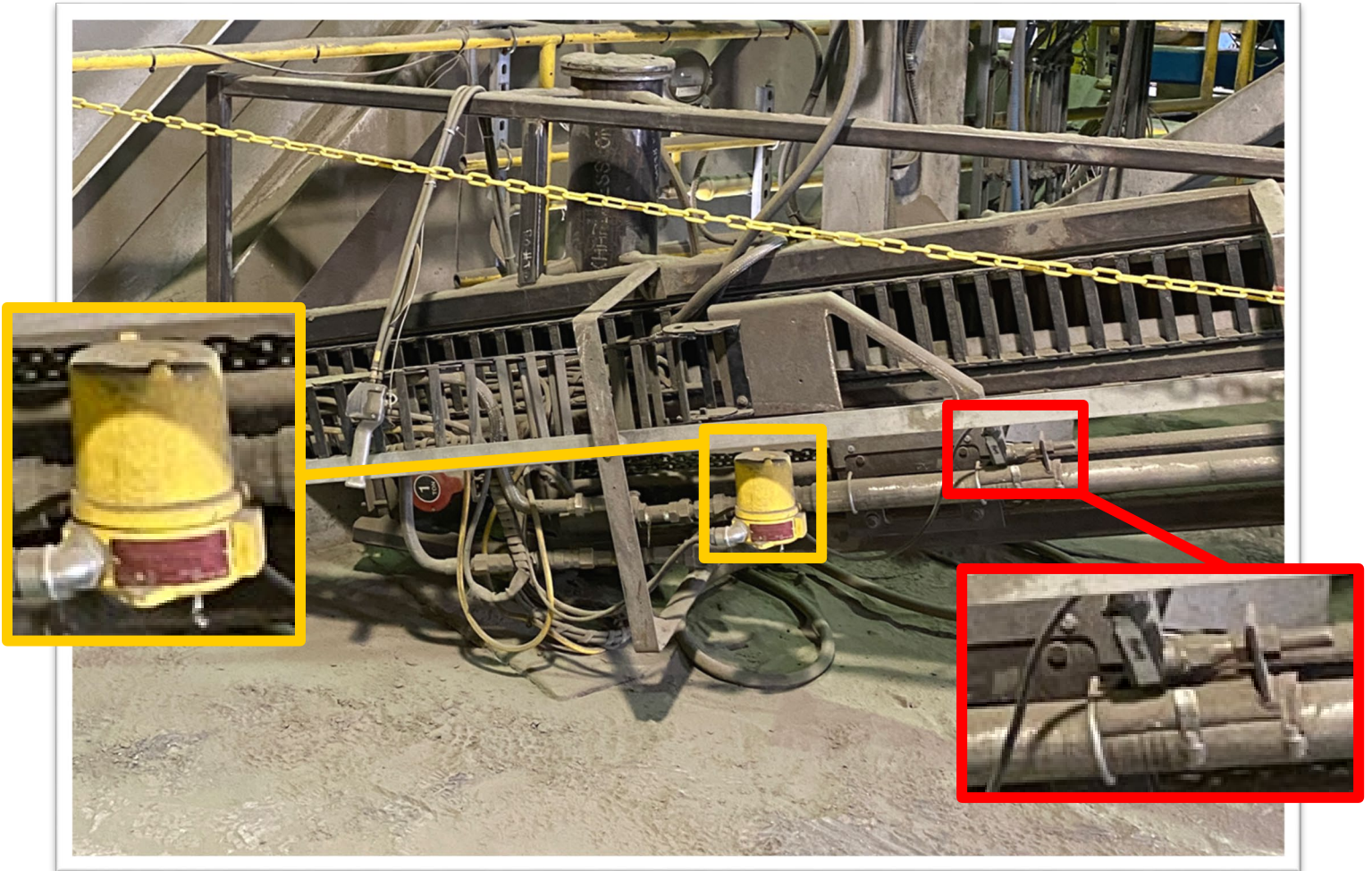


Photo 3 (*Photo taken before incident*) - Pilot tube assembly on retractable rail. **RED** - the proximity sensor. **YELLOW** - ignitor enclosure.

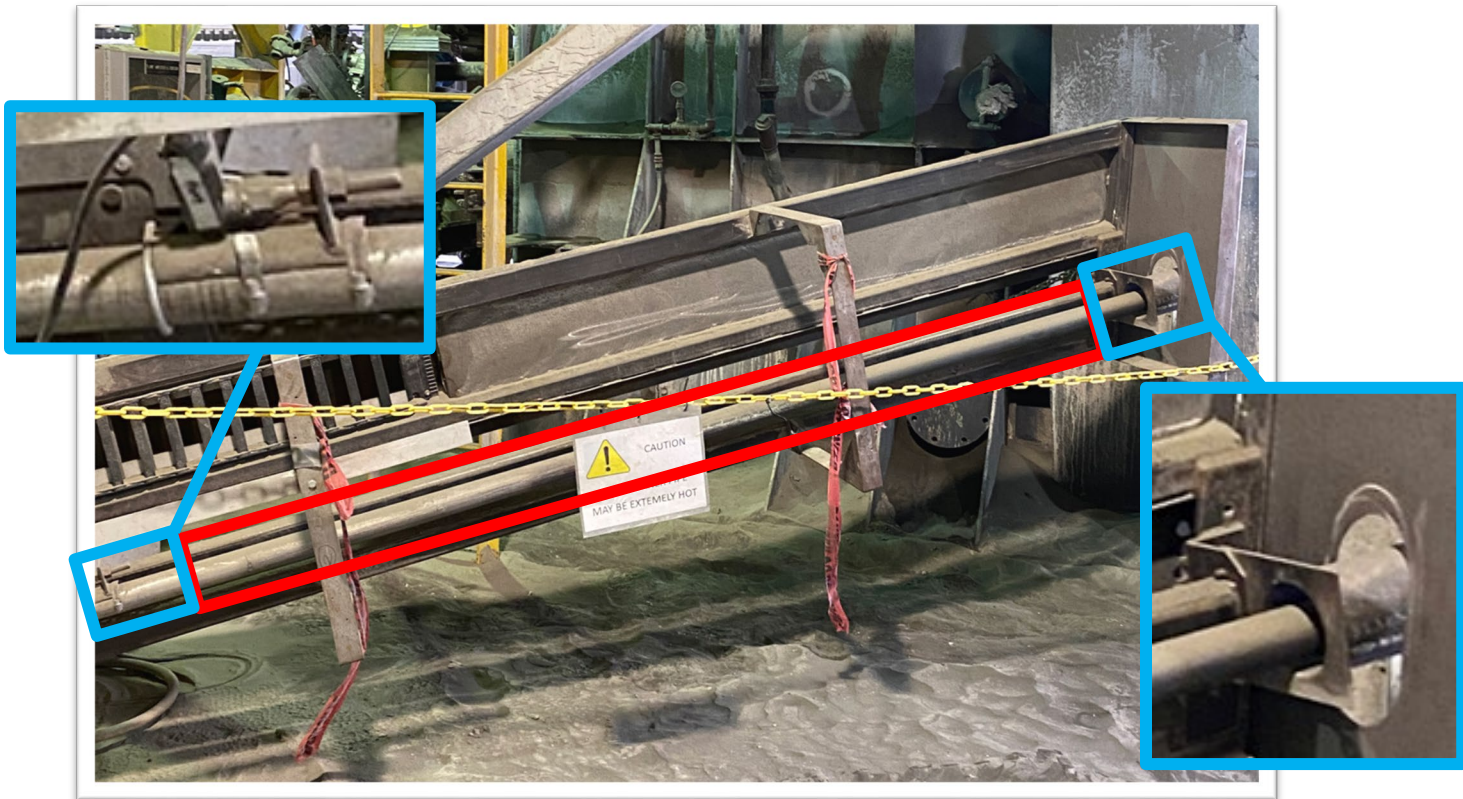


Photo 4 – **RED** - pilot tube retracted from kiln. **BLUE** - proximity sensor and flange that will close the switch when it the sensor close to it.