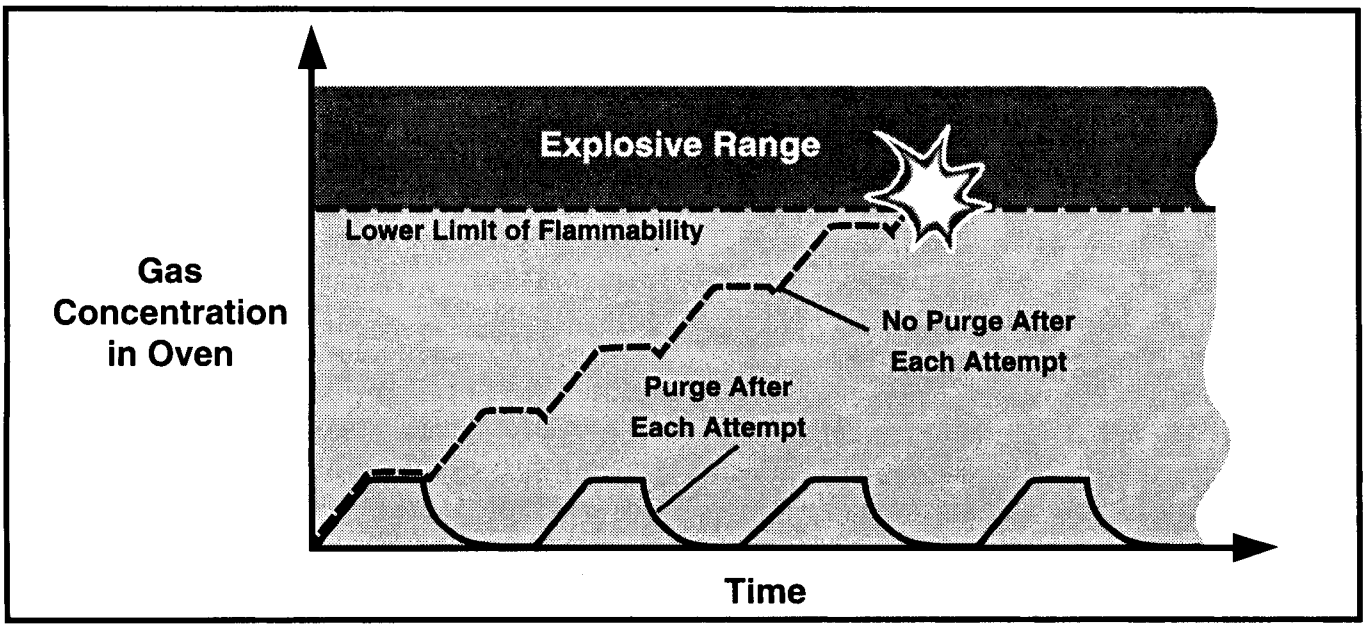
Janus Technology Group's

Foresight & Hindsight No. 6

Losing at Russian Roulette



Another person died recently.

"So?" You say, "Thousands die every day." Yes, but this one died in an industrial oven explosion after playing Russian Roulette with the oven's purge. It's not the first time this sort of thing has happened.

You're familiar with Russian Roulette — put one bullet in a revolver, spin the cylinder, point the gun at your head, pull the trigger and pray. With Purge Roulette, the rules are a little different. If you don't shoot yourself the first time, you put a second bullet into the chamber. Each time you get lucky, you chamber another round until the cylinder's full.

Oven and furnace control systems require the combustion air or exhaust fan to purge the work chamber before the burner's pilot or igniter can be lit. This removes any gas or flammable vapors that may have accidentally accumulated since the last shutdown.

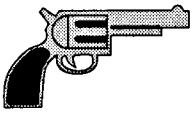
Where would they have come from? Perhaps the shutoff valves leaked over the weekend, or maybe the oven contained some unburned fuel from a startup attempt that failed.

As a rule, at least 4 volume changes are required to drive out most of the flammable gases and dilute any that remain below their lower limit of flammability. The fan damper is driven to the wide open position (if it's adjustable) and the fan is allowed to run long enough to provide the required number of air changes. Depending on the size of the fan and the volume of the oven, this can take several minutes. The whole operation is regulated by a timer in the combustion control panel.

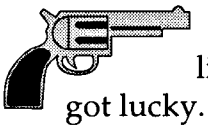
The Roulette game starts when somebody gets impatient, usually when the burner fails to light after several tries. After repeatedly waiting for the purge timer to do its thing, they get the bright idea to dial its setting down to zero or to bypass it with a jumper.

(over)

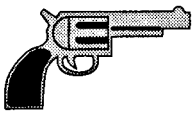
Russian Roulette (Continued)



On the next ignition attempt, some gas is put into the oven. Round 1 is in the cylinder.



Skip the purge and try to light again. *Click.* Allll Right! -- got lucky. Now bullet two is chambered.



Try again. *Click.* Phew! But now, bullet 3 is ready to go.

Sooner or later, the concentration of gas builds up to its lower limit of flammability. It's now a combustible mixture, and on the next lightoff attempt, the oven explodes. **Now** you understand why the purge is essential — it would have flushed out the gas that gathered in the oven after each failed lightoff attempt. Bypassing the purge each time allows the gas to gradually build up to an explosive concentration.

To avoid becoming a victim of Purge Roulette:

1. Never, **Never, NEVER** dial down the purge timer or bypass it, no matter how aggravating that wait is. The poor little timer is only trying to protect your life. Even if there's a long wait between lightoff attempts (for example, while someone's trying to adjust the burner or pilot), don't assume the oven will purge itself.

2. If the burner won't light after two or three attempts, **quit trying**. Something's obviously wrong. Check the equipment out -- maybe the spark igniter's broken or a gas valve isn't opening.

3. If you haven't done so recently, check the purge timers on your gas-fired ovens and furnaces. Make sure the times are set correctly and that there are no jumpers. Otherwise, the next person to start the equipment may be an unwitting player in a game of Purge Roulette.

What If?

At some of our Combustion Training Seminars, this question has been raised:

"What if the combustion air blower is left running after shutdown? Doesn't that continuously purge the combustion chamber, so a prepurge on relight is unnecessary?

We'll answer with two questions of our own:

- Did the blower run long enough and at a high enough flow rate to give you the equivalent of a proper purge (at least 4 air changes)?
- Are you sure no gas valves were open or leaking while the blower was running? This will cancel out some of the benefit of the purge.

If you can't positively say yes, stick with the prepurge. And any time a burner lightoff attempt fails, you **must** purge, because now, there's **definitely** gas in the chamber.

Never Say Never

NFPA 86, Ovens and Furnaces, 1999 edition, does permit relight attempts without re-purging if:

(a) The heating chamber temperature exceeds 1400°F (760°C) and:

(b) For any fuel-fired system, if:
(1) each burner and pilot is supervised by a combustion safeguard
(2) each burner system is equipped with safety shutoff valves
(3) at least one burner remains operating in the common combustion chamber of the burner to be reignited.

(c) Or, for gas-fired systems only, if:
Conditions (b) (1) and (b)(2) above are satisfied, plus:
(3) it can be demonstrated that the combustible concentration in the heating chamber cannot exceed 25 percent of the LEL*.

* LEL = **L**ower **E**xplosive **L**imit, the minimum combustible concentration of gas in air.

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P. O. Box 2872, Rockford, IL 61132-2872, Phone 815-282-8044, FAX 815-282-8043, E-mail: janustech@compuserve.com