Q: What is the recommended purge time for a fuel cell test system. Why is a purge necessary? When is it appropriate to perform a purge step or process?

A: "Purge" refers to flowing an inert gas through the test system and the cell prior to or after flowing reactant, such as hydrogen (H_2) and air/oxygen (O_2). The most common purge gas is nitrogen (N_2) although Argon and Helium are sometimes used as well.

A purge process is recommended at start-up and shut-down of the fuel cell and/or test system. A newly assembled fuel cell or even a "used" cell that has been exposed to air by sitting on a lab bench must be purged of air that is entrained in the anode compartment prior to introducing H_2. If the air is not first replaced with an inert gas, and H_2 is immediately introduced into the anode compartment, then the anode catalyst layer will be exposed to mixture of air (*i.e.*, O_2) and H_2 in the presence in platinum (Pt), which may lead to combustion and irreversible damage to the membrane electrode assembly (MEA).

Purging is also recommended when the test system is to be shut-down, which is a safer state to the leave the equipment in than with the gas path full of a combustible gas. This is obviously more important for the anode (H_2 side) than the cathode, unless the reactant used in the latter was pure O_2, in which case it just as important to remove the system of O_2 as it is H_2.

The purge can be thought of as a simple displacement process: the reactant gas (*e.g.*, H_2) is displaced by the purge gas. As such, the time it takes to adequately purge the system is a function of the volume of the reactant to be displaced (*i.e.*, the gas path volume) and the purge gas flow rate. The higher the flow rate, the shorter the purge duration. Likewise, the larger the volume of gas to be displaced, the longer the purge duration.

For example, the volume of the gas path in an 850 Fuel Cell Test System is approximately 0.5 L. As a rule of thumb, the volume of purge gas should be ~ 10x the volume of the reactant to be displaced. Therefore, ~ 5 L total purge gas volume, or ~ 10 min at 0.5 SLM or 5 min at 1 SLM.

Q: Yes, if it is possible to restrict the N2 purge for specific time frame, that could be great. Meaning, we need two restrictions, flow rate and time- that needs to be defined (this flow rates and time frame should be according to the volume of the system) when the systems stops working due to H2 leakage detection.

KRC – Can the desired action(s) be achieved with a Shutdown Sequence, an example of which is attached.

1. Shutdown Experiment – turn OFF load, fuel (switch to purge) and temps
2. Change Fuel step – Sets fixed flows for the purge.
3. OCV Step – 10-15min for the purge
4. Change Fuel Step – set flow to zero. Also, check the "Copy to Background" box so that the zero flows become the new background set point.

5. OCV Step – very long duration (e.g., 48 hr) so that it will still be running when you return to manually take over control of the system.

If the system is running a list of experiment when an H2 alarm occurs, the system will turn OFF the load, fuel (switch to purge) and temps but will continue “run“ the list of experiment list IF you have unchecked the “All Alarms Stop Experiment List” in the Alarms tab of Instrument Configuration. If your experiment list includes a Shutdown Sequence similar to the above near the end of it then the flows will be set to zero. This is the only way that I can think of to implement this.