Keith,

Based on my understanding of arc and plasma physics:

A low voltage arc can certainly last a long time over a short distance, e.g., the arc welder. Even two car batteries in series (24 V) can sustain a low voltage arc over a couple of mm. Farmers make a field welder by using two car batteries in series with a bucket of salt water to provide resistance to moderate the current.

So, your supposition that the arc self clears before the breaker trips is not correct. A 120 V arc could continue for a long time if the breaker does not trip. It will melt a lot of the conductors at either end of the arc, as the short circuit current will be high, 1000 A or more, if the breaker does not trip.

Your statement that the worker is endangered from this arc is correct. The danger is due to the heat at the arc, the molten metal, and possible sparks thrown out. This is the same danger as of any high current arc, such as an arc welder. The danger is to the hands and any other body part within a few mm, due to the infrared heat. Also, small sparks could be thrown, basically endangering the eyes. This is the hazard and injury mechanism to the child who sticks a metal object into the outlet, and the reason for the 2008 NEC requirement for child proof outlets. The PPE for protection against the arc would be protection of the hands against heat, and the eyes against sparks and UV, just like a welder wears.

The hazard from a low voltage arc is an arc hazard or thermal hazard, NOT an arc flash hazard.

Your belief that there would not be 5 J/cm2 is also correct, but for a different reason. To create an arc flash hazard requires two items, sufficient voltage to allow the arc and its resultant plasma ball to grow, and current or energy to feed the arc. If the voltage is low, the arc remains small and stable and can not expand, i.e., the arc welder.
The 120/240 arc extinguishes, because the breaker trips, not because the voltage is low. It just never grows. Somewhere above 250 V, the arc plasma begins to expand. The voltage is high enough to overcome the arc resistances at the anode and cathode, and begins to drive current through the conductive plasma cloud. The plasma itself is conductive, as Michael Faraday showed well over a century ago. The expanding plasma, maintained by sufficient voltage and fed by energy, is not only self sustaining, but grows, as it ionizes more air, and continues to expand. The degree of expansion is determined by the available energy, thus leading to an arc flash boundary. If there is insufficient voltage, the arc plasma does not expand (the 250 V limit). If there is insufficient energy, the arc flash boundary is small (e.g., a 1 Joule high voltage capacitor).

The 250 V threshold in 70E is largely based on empirical observation, but it is backed by arc physics principles. The 125 kVA limit is largely based on, not that a 200 kVA fed 120 arc would have an arc flash, the voltage is still too low, but that so much energy going into a 120 V arc would really melt a lot of material, create strong magnetic forces, and throw a lot more sparks. The welder analogy would be, you do not want a 2000 A steady state 18 V arc. You just couldn't handle the other issues, the electrodes would melt really fast, the welder cables would move around (due to strong Lorentz forces) and the IR heat would really be intense. There would still not be an arc flash hazard but the arc hazard becomes unmanageable. Thus, more current is not better in a welder, they need to limit the current to around 500 A or so.

Summary:
There is no arc flash hazard below 250 V.

There is an arc hazard below 250 V, hands and eyes must be protected, but arc flash PPE is not necessary. Below 125 kVA the arc hazard is not severe. The arc hazard above 125 kVA and below 250 V would be harder to manage., there is still no arc flash hazard, just lots more sparks and UV.

I hope this all makes sense.

Lloyd