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Subject: Yellow Alert: Oven Temperature Controls- Setpoint or Shutdown?

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LESSONS LEARNED: After discovering that an oven had overheated and destroyed an environmental experiment, personnel determined that the oven controller they thought functioned as an overtemperature cut off actually was programmed as a high temperature setpoint. Because personnel failed to adequately identify potential hazards associated with oven operation such as setpoint malfunction, extremely high temperatures, power interruptions, or potential byproducts created during thermal excursions, no mitigating controls were in place. Personnel are now required to read the oven manual, a new hazard analysis was completed, and an overtemperature setpoint and shutoff was established.

DISCUSSION: Personnel entering a facility to conduct routine operations noted an unusual sound and smell coming from an oven attached to an environmental chamber. The temperature readout on the Terra Universal brand oven was 340 degrees C; the desired oven temperature was 30 degrees C. The personnel shut down the oven and secured it. The nitrogen atmosphere oven held glass containers with plastic lids,filled plastics, and a nitrated plasticizer. The unusual sound the personnel heard was the purge valve operating in the full-on position to maintain nitrogen pressure in the oven after the primary seal failed. The oven was examined after it had completely cooled. No evidence of a reaction or flame was identified. The container lids melted or degraded, the plasticizer evaporated, and the filled plastics appeared to degrade. Damage to the oven was limited to seal damage from excessive heat conditions. The experiment in the oven was completely destroyed, resulting in a loss of programmatic information.

ANALYSIS: The oven is equipped with dual Honeywell UDC 1000 Micro-Pro Controllers, one of which was set for 30 degrees C and the other was set for 350 degrees C. The lower setpoint temperature was used for controlling the experiment, while the higher setpoint was factory set to limit heat damage to the equipment. After a spot weld developed on the contact points for the lower setpoint controller, the controller failed in the closed position and the oven temperature increased to the higher setpoint. Facility personnel believed the second controller would act as an over temperature cutout; however, it was internally programmed to act as a second control point. All personnel using ovens at the facility are now required to read the associated oven equipment manual to ensure that they understand how the equipment is configured and intended to operate. Personnel also determined that a more thorough hazard analysis should have been conducted for the experiment. Potential hazards created by setpoint failure, extremely high temperatures, power interruptions, or potential experiment byproducts were overlooked. A new hazard analysis was performed for the experiment heated in the oven to address these previously unrecognized hazards.

RECOMMENDATIONS: Ovens used for hazardous materials should be configured to allow for redundant independent primary and overtemperature relays and controllers. The

overtemperature relay should be configured to act as a system shutoff. The critical temperature for materials heated in ovens should be identified and the overtemperature setting should be significantly lower than the identified critical temperature. Calculations of critical temperature should include consideration of reactivity, phase change, flammability, and time at temperature.

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FOLLOW-UP ACTIONS: Information in this report is accurate to the best of our knowledge. As a means of measuring the effectiveness of this report, please contact the originator of significant action(s) taken as a result of this report or of any technical inaccuracies you find. Your feedback is appreciated.