# Using a hotplate with flammable liquid

Table 10-3

| **Department: Chemistry** | **Description of Operation:**  **Use of stirring hotplate with flammable liquid** | | | **By:**  **Review Team Date:** |
| --- | --- | --- | --- | --- |
| **What if?** | **Answer** | **Probability** | **Consequences** | **Recommendations** |
| Use on unventilated benchtop | Flammable vapors could accumulate and reach source of ignition fire | High | Extensive damage/downtime and costs | Use in fume hood |
| Overexposure to toxic vapors | High | Adverse health effects | Use in fume hood |
| Mechanical failure of fume hood exhaust fan | Lack of exhaust but vapors still accumulate and ignition sources still present | Moderate | Adverse health effects | Interlock hotplate power to exhaust monitor |
| Fire | Moderate | Damage | Use explosion proof hotplate |
| Power failure during use (see also loss of heat and loss of stirring below) | Lack of exhaust, vapors may accumulate but at lesser magnitude, potential fire | Very high | Damage/health effects | Connect exhaust fan to emergency power |
| Reaction becomes unstable | Very high | Failed experiment, exposure to unknown products | Conduct a review of all possible reactions and outcomes |
| Hotplate malfunction, electrical arcing (switch/ thermostat) | Possible fire in hotplate and ignition of solvent vapors | Moderate | Equipment damage/personnel injuries | Check electrical connections (plugs and wires); pretest hotplate before starting; use explosion proof hotplate |
| Hotplate malfunction, supplies too much heat | Heat material above flash point | Moderate | Fire, damage, personnel injuries | Interlock hotplate to temperature feedback loop |
| Reaction becomes unstable | Moderate | Personnel injuries | Do not leave reaction unattended; check temperature of reaction at regular intervals |
| Unintended reaction occurs | Moderate | Hazardous byproducts | Conduct a review of all possible reactions and outcomes |
| Hotplate malfunction; supplies too little heat; if no heat, see loss of power above | Reaction unsuccessful | Moderate | Lost time and materials | Interlock hotplate to temperature feedback loop |
| Reactants degrade/ evaporate | Moderate | Lost time and materials; hazardous byproducts | Do not leave reaction unattended; check temperature of reaction at regular intervals |
| Loss of Stirring | Superheating of portion of flask contents | Very high | Vessel fails/fire | Interlock hotplate to temperature feedback loop |
| Unintended reaction occurs | High | Hazardous byproducts | Conduct a review of all possible reactions and outcomes |
| Reaction unsuccessful | High | Lost time and materials | Do not leave reaction unattended; check temperature and stirring of reaction at regular intervals |
| Spill from container being heated | Flash fire | High | Fire/damage/ personnel injuries | Do not handle hot vessel |
| Reaction unsuccessful | High | Lost time and materials | Do not leave reaction unattended |
| Heating period is too long | Open container boils dry | High | Failed reaction | Connect hotplate to timer and temperature feedback loop |
| Vessel breaks | High | Vessel fails/fire | See above |
|  | Reaction unsuccessful | High | Lost time and materials | Do not leave reaction unattended |
| Heat period is too short | Unreacted starting material | High | Hazardous byproducts | Connect hotplate to timer and temperature feedback loop |
| Unstable products | High | Personnel injuries | Conduct a review of all possible reactions and outcomes |
| Reaction unsuccessful | High | Lost time and materials | Do not leave reaction unattended |
| Container breaks | Flash fire | High | Fire/damage/ personnel injuries | Check container for signs of prior damage or use new container |
| Residual process gas in equipment when opened | Vessel breaks | High | Fire/Damage/ personnel injuries | Do not use a closed container; use container with a pressure relief device |
| Vessel cannot be opened | High | Lost time and materials | See above |
| Unintended reaction occurs | High | Hazardous byproducts | Conduct a review of all possible reactions and outcomes |

This file is excerpted from “Identifying and Evaluating Hazards in Research Laboratories: Guidelines developed by the Hazard Identification and Evaluation Task Force of the American Chemical Society’s Committee on Chemical Safety”.

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