Step 1: Choose a paper

Paper chosen: Investigating Contactless High Frequency Ultrasound Microbeam Stimulation for Determination of Invasion Potential of Breast Cancer Cells (https://www.ncbi.nlm.nih.gov/pubmed/23568761)

Step 2: Recognize hazards

Laboratory Experiment Hazard Identification Checklist

HAZARDS	YES	DETAILS
CHEMICAL		
Toxic Chemicals		
Acute toxins	☐	
Chronic toxins	☐	
Carcinogens/teratogens/mutagens	☐	
Flammables/combustibles		
Flammable liquids		
Flash point ≤ 100 ºF	☐	
Flash point > 100 ºF	☐	
Flammable solids	☐	
Flammable gases	☐	
Pyrophoric materials	☐	
Corrosives/reactives		
Acids	☐	
Bases	☐	
Oxidizing/reducing agents	☐	
Fluorine/fluorination agents	☐	
High-pressure/liquid oxygen	☐	
Peroxides/peroxide-formers/azides	☐	
Water-reactives	☐	
Nanomaterial	☐	
BIOLOGICAL		
Organisms		
Laboratory animals	☐	
Agricultural pathogen	☐	

Human pathogen	☐	
Human cell line (including cancer)		Breast cancer cells are cultured for experiment
Recombinant/synthetic DNA	☐	
Tissues		
Human (including cadaver or cadaver-derived)	☐	
Primate	☐	
Animal	☐	
Biotoxin/Select agent	☐	
RADIATION		
Ionizing		
Hard UV, X-ray, γ-ray	☐	
Charged particles (α, β)	☐	
Neutron	☐	
Non-ionizing		
Soft UV, visible, IR, μ-wave, radio	☐	
Lasers		
Class 1, 2, 3R	☐	
Class 3B	☐	
Class 4	☐	
PHYSICAL		
Pressure		
Compressed gases/pressurized equipment		Compressed CO_2 gas cylinders are used to culture cells
Vacuum	☐	
Hydraulics/pneumatics	☐	
Electricity		
High voltage (>400V)		Hydrophone is used to measure ultrasound field which requires high voltage
Low voltage	☐	
Magnetics/high-current apparatus	☐	
Stored energy (large capacitors/inductors)	☐	
Temperature		
Cryogens	☐	

Low temperature (<273K)	☐	
High temperature (>325K)	☐	
Sparks/hot work/open flames	☐	
Machinery		
Moving parts/pinch point/shear points	☐	
Sharp edges/puncturing parts	☐	
Compression/rolling object	☐	
High rotational energy	☐	
Stored mechanical energy	☐	
Overhead hazards	☐	
Trips/fall/slip	☐	
Sharps/needles/glassware		Burette is used during cell culturing
Noise/vibration	☐	

- Compressed gases/pressurized equipment: Joey is doing experiments near CO_2 cylinders. If the pressure is suddenly released, the samples can throw parts around the lab as shrapnel or become missiles. It can also generate large amounts of vapor if release happened, so asphyxiation becomes more of a hazard.
- High voltage (>400V): Joey uses electricity to operate electronic device and even use it as a reactant or object of study. Electricity can present hazardous shock to lab researcher: Electricity flow through the heart is particularly dangerous. Shock injury is current-dependent. Body resistance varies widely, so the amount of current varies as well, sometimes unpredictably. The result is disruption to electrical systems in the body (nervous and cardiovascular) and burns to skin.
- Sharps/needles/glassware: Sharps hazards include anything capable of puncturing or cutting, including broken glass and glass pipets. Sharps present hazards like physical injury of the cut or puncture. Also, if the sharp is contaminated with chemical, biological, or radioactive material, the wound effectively injects that material directly into the body, bypassing the protective features of the skin.
- Human cell line (including cancer): Joey is culturing cells with open wounds, injection might happen (even if he wears gloves).

Step 3: Assess risk

- Compressed gases/pressurized equipment: Low
- High voltage (>400V): Medium
- Sharps/needles/glassware: Medium
- Human cell line (including cancer): Medium

Step 4: Mitigate risks

- Human cell line (including cancer): Call the emergency number immediately.
- Sharps/needles/glassware: Wearing cut-resistant gloves underneath nitrile examination gloves. Call the emergency number if Joey is already hurt.
- High voltage (>400V): In case of an electrical accident, act quickly. Joey only has a couple minutes before the victim survival rate drops substantially. Do not approach or touch victims until he is certain the power is disconnected and there is no residual voltage—some equipment can carry voltage for an extended period, even when off, as capacitors bleed down, etc.
- Compressed gases/pressurized equipment: Have the compressor and the piston be a part of the controller to ensure that the piston position is controlled based on actual CO2 pressure (using a pressure sensor). In the case of leak, enter the evacuation route.

Step 5: Prepare for emergencies

- Sharps/needles/glassware: Keep sharps off the benchtop. If Joey need to put down a razor blade, for example, place it in a shielded area such as a Petri dish so that others are not injured by it. Never recap a needle. Injuries while recapping needles are common.
- High voltage (>400V): Joey should receive special training before conducting high-voltage (greater than 400V) or ultra-high-voltage (kilovolt-range) research.
- Compressed gases/pressurized equipment: Joey should never install a pressure regulator on a cylinder when it is in transport. Secure the cylinders to a fixed cylinder support (wall-mounted or clamped to a lab bench) when they are not being transported.
- Human cell line (including cancer): Disinfect or sterilize all contaminated labware and samples before experiment and disposal.