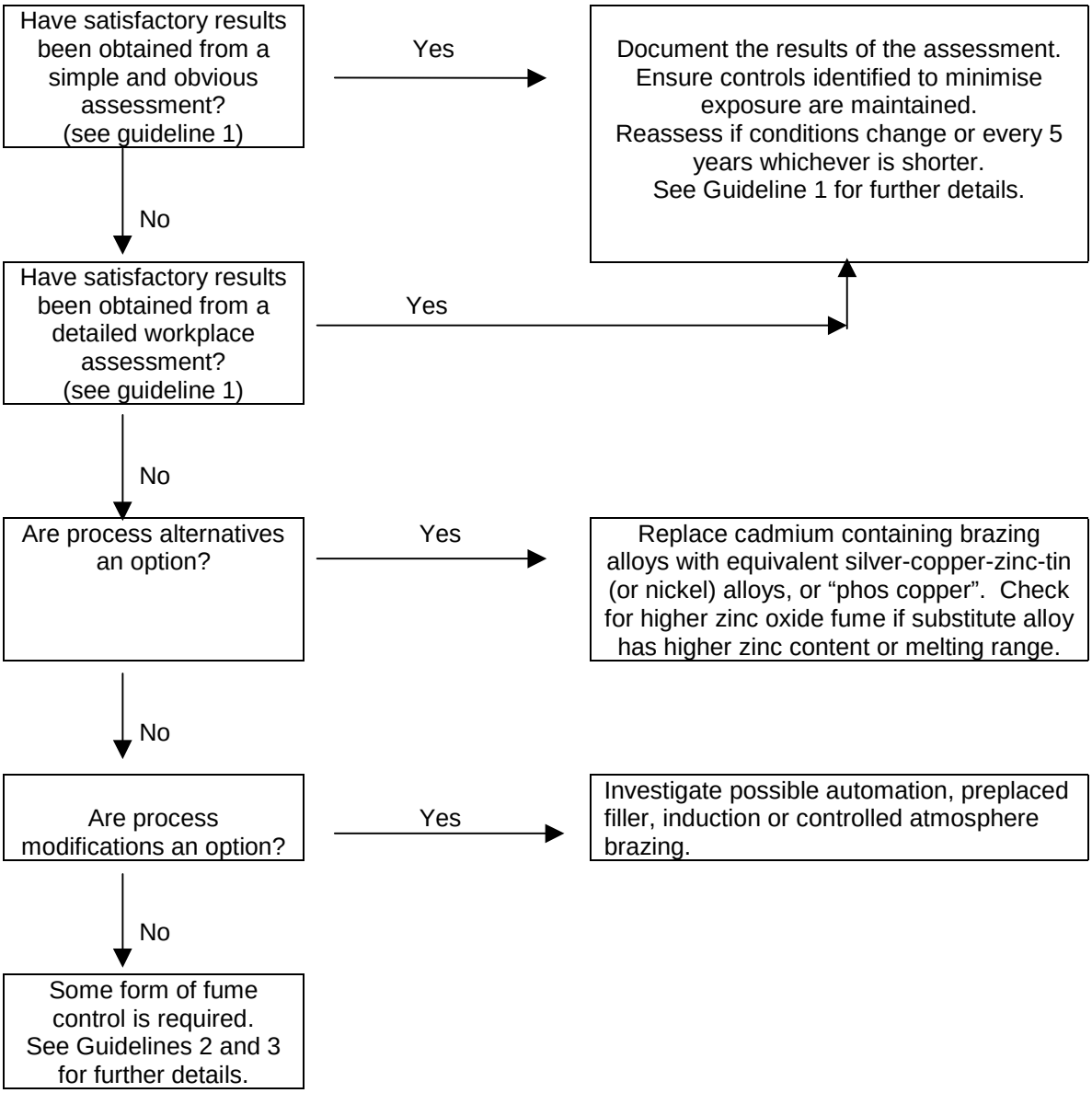
FUME MINIMISATION GUIDELINES

GUIDELINE 15:

GENERAL INDUSTRIAL BRAZING

An employer has a duty to ensure that a suitable and sufficient assessment is made where there is potential for exposure to hazardous substances.
For intermittent work, not involving cadmium, indium or lithium, no special measures may be necessary to protect the operator provided clean air movement is greater than 0.5 m/s across the operators breathing zone. Accumulation of fumes in the workshop must be prevented by general ventilation.



Notes:
1. Ventilation by local exhaust will usually be required. In cases where cadmium, indium or lithium fume occurs, personal respiratory protection will also be necessary.
2. Under normal circumstances it should be possible to satisfy the regulatory requirements by process and work practice modifications. Known exceptions are still air, confined spaces (see AS 2865 "Safe Working in a Confined Space") or where particular hazards are identified in Material Safety Data Sheets.

SCOPE

Covers capillary brazing of iron, copper, nickel and precious metal alloys, indeed all alloys of appropriate melting point that can be successfully fluxed or prevented from oxidation by controlled atmosphere or vacuum furnace heating including dissimilar metals, cemented carbides etc.

Materials

Filler Metals

Filler metals most commonly used fall into one of two broad classes:

1. ***Low Temperature Brazing Alloys (melting range 600-850^{0}C) which include silver solders.*** These are silver/copper alloys commonly with significant amounts of zinc and cadmium (or tin and nickel) and sometimes manganese for use with certain nickel alloys, stainless steel and cemented carbides. Also included are copper alloys with high phosphorus and usually some silver for self fluxing brazing of copper ("phos copper").

2. ***High temperature brazing alloys (melting range 890-1085^{0}C.)*** These include most commercial grades of copper, some brass and bronzes alloyed with silver and copper alloys with small additions of boron, nickel, manganese and silicon usually for protective atmosphere furnace brazing of steel and carbides. Also a few specialist alloys such as 82/18 gold/nickel for high temperature oxidation resistance are used.

Fluxes

The common silver brazing fluxes are complex mixtures of potassium fluorborates, bi-fluorides and borates, sometimes with small amounts of potassium hydroxide and chloride. For prolonged heating of steels, particularly stainless and for materials rich in chromium carbide, fluorosilicates and boron are included whilst for aluminium bronzes, sodium aluminium fluoride/sodium fluoride handle the aluminium oxide.

Processes

Torch (with hand fed rod or preplaced filler), automated with gas/air burners, induction and furnace (controlled atmosphere or vacuum) all with preplaced filler and resistance (spot brazing).

HEALTH EFFECTS

Metal Fume

When present, zinc, cadmium and sometimes lithium or indium oxides are the main metal fume constituents. Cadmium is a very toxic metal whose fume in high concentrations causes a range of chest and lung problems which can be fatal. Long term low concentration exposure can affect sense of smell, weight loss and induce emphysema, pulmonary fibrosis, kidney damage and possibly cancer. Using proper heating techniques, fluxing and avoiding overheating, manual torch brazing can give metal and oxide fume from brazing alloy constituents (other than cadmium and zinc) that are low enough to be discounted as health hazards. Excessive exposure to zinc oxide can cause metal fume fever.

Flux Fume

Commonly contain hydrogen fluoride and boron trifluoride also sodium aluminium fluoride and sodium fluoride in some formulations. Dusts of boric acid, potassium hydroxide, potassium chloride and potassium tetraborate can arise dependent on flux type. Toxic and corrosive if swallowed, these fumes (particularly halides) irritate eyes, skin and respiratory tract. Long term exposure to fluoride dusts and vapours can give fluoride poisoning (fluorosis).