AM Safety ST 001 v1
Guidelines FPS Isolation - Appendix 1

Appendix 6: Example of a selection tool to establish the 'baseline standard' for a final isolation

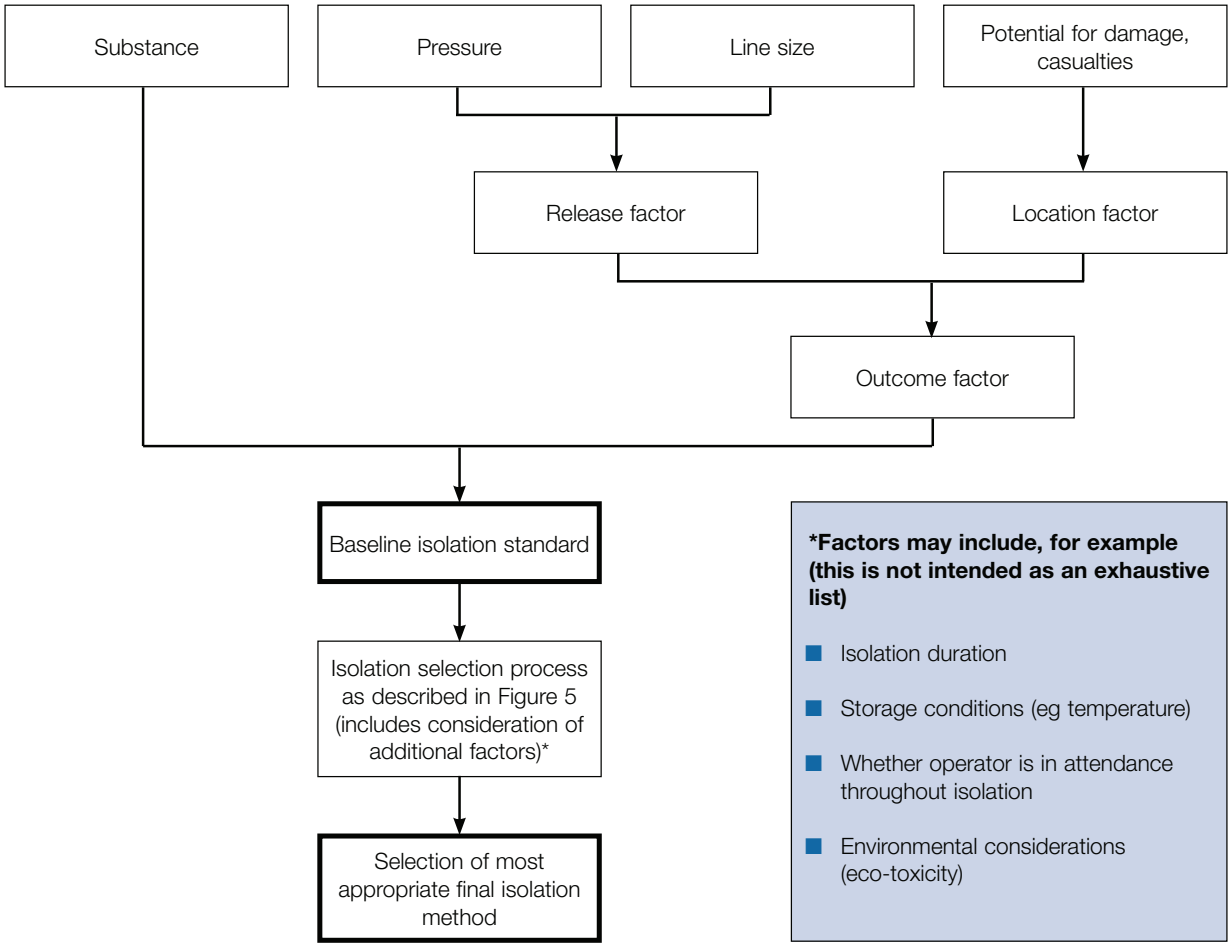

Figure 11 Overview of use of the selection tool to select a final isolation method

Application of the selection tool

1 The tool is **not** intended to be used for:

- pipelines;
- extended term isolations; or
- 'high risk' situations eg;
  - confined space entry;
  - where the result of isolation failure could be catastrophic, or a situation from which recovery would be very difficult.

2 Before carrying out **any** isolation to enable intrusive work, ensure that you have minimised the risk associated with the task. You may be able to:

- shut down the relevant plant to enable work to be carried out safely, or postpone the job until the next planned shutdown;
- remove the need to break containment by using a different method to carry out the work; or
- minimise risk by other measures eg reduction of inventory and/or of the number of people exposed to risk.

3 Remember that a selection tool can complement, but cannot replace, competent technical judgement and common sense.

4 The tool has been calibrated against industry good practice for work on live plant. It gives a **baseline** isolation standard (provisionally the minimum acceptable standard for final isolation). This baseline standard is an input to the isolation selection process in Figure 5.

5 The tool is **not** designed to produce a final decision on the most appropriate final isolation standard and **must not be used in this way**. Full consideration of an individual isolation (including eg isolation duration, storage temperature, personal injury hazards etc) will be required to enable selection of the most appropriate final isolation standard.

Substance category

6 Use the guidelines below to select the appropriate substance category, or categories, from the list in Table C. These are primarily (but **not** exclusively) based on the classifications given in the *Chemicals (Hazard Information and Packaging for Supply) Regulations 2005* (CHIP). CHIP substance classifications are given in the current version of the Approved Supply List[26] (ASL) to these regulations. For Table C, note that some categories (eg steam) are **not** based on CHIP classification.

7 Ensure that you identify all of the relevant categories for the substance to be isolated (eg flammable **and** toxic, or petroleum product **and** carcinogen). You should then assess each category and select the highest of the indicated isolation standards as your baseline standard.

8 For mixtures and preparations (including solutions), use the CHIP classification appropriate for the pure substance **unless either**:

- the substance entry in the ASL shows it to be:
  - within specified concentration limits such that an alternative classification applies (eg hydrogen sulphide, methanol); or
  - below its lower limit of concentration; or
- the substance is present at a level below the lower limit of concentration for the relevant classification, as given in Schedule 3 to the CHIP Regulations.[26]

9 Where substances are neither listed in Table C nor classified under CHIP, you should obtain specialist advice.

10 Remember that additional hazards may be associated with the storage conditions of unclassified fluids, eg hot water subject to gas pressure or capable of flashing to steam on release, cryogenic storage, gases stored under pressure. You should then consider defaulting to category 2.

11 Categories have been based on the potential for **harm to humans**. You may also need to take into account the potential for **environmental** damage.

12 If in doubt about the appropriate category to use, you should always err on the side of caution.

Category	Description (CHIP classification, where appropriate)
1	Very toxic (T+) Toxic (T) Carcinogenic, mutagenic, toxic for reproduction Sensitising
2	Extremely flammable (F+) Highly flammable (F) Flammable gases (R10) Flammable liquids (R10) - unless included in category 4 Petroleum products* - unless included in category 4 - consider whether category 1 is appropriate Oxidising (O) Explosive (E) Steam Pressurised gases >250 bar.l, with pressure of 0.5 bar or higher Flashing fluids Asphyxiants
3	Corrosive (C) Harmful (Xn) Irritant (Xi)
4	Flammable liquids stored below flashpoint, and below flash point following release (R10)
5	Non-classified and not stored in a potentially harmful state

Table C Substance category

Note: * Petroleum substances are specified individually within category 2 because, for these substances, CHIP contains only a partial entry (ie classification for carcinogenicity only, not for flammability), as explained in note H to the *Approved Supply List*.[26] For the purposes of this selection tool, both flammability and carcinogenicity should be considered.

Release factor

13 Combine line size and pressure to give a **release factor** (this reflects the potential rate of release). The options are high (H), medium (M) and low (L), as shown in Table D:

		Pressure		
Line size		>50 barg	I 50 but >10 barg	<10 barg
	J20cm	H	H	M
	5cm< line<20cm	H	M	L
	I 5cm	M	L	L

Table D Release factor

Location factor

14 Consideration of the location should include the potential for casualties (numbers at risk), escalation and damage if a release occurs. Take into account the nature of the possible consequences if the isolation fails, eg vapour cloud explosion (VCE), toxic gas cloud, jet fire with potential for escalation etc. The categories for **location factor** are again high (H), medium (M) and low (L), as defined in Table E:

Category	Description
H	Any of: Numbers at risk >10; congested equipment; potential for escalation; large fires with potential for damage and multiple fatalities
M	Typically: 3-10 at risk; uncongested plant, storage area or small number of items in open area; minor fire
L	Characterised by: 1-2 at risk; remote single items; easily contained minor fires

Table E Location factor

Outcome factor

15 Combine the **release factor** and **location factor** to give an **outcome factor**, in the range A-C, as shown in Table F:

		Release factor		
		H	M	L
Location factor	H	A	B	B
	M	B	B	C
	L	B	C	C

Table F Outcome factor

Determination of baseline isolation standar

16 The substance category and outcome factor are then combined to indicate the appropriate **baseline standard** for final isolation (Table G).

		Outcome factor		
		A	B	C
Substance category	1	R	I	I
	2	R	I	II
	3	I	II	II
	4	II	II	II
	5	II	III	III

Table G Baseline standard of isolation

Where:

R Consider whether the associated risk is acceptable or whether there is a need to further reduce risk by eg risk reduction measures, extending the isolation envelope, plant shutdown
I Positive isolation
II Proved isolation
III Non-proved isolation

17 Having identified the appropriate baseline standard, **full consideration** of an individual isolation will be required (see Figure 5) to enable selection of an appropriate final isolation standard. The baseline standard is based on consideration of major hazard risks – before selecting a final isolation method, you need to consider **all** relevant risks (including those due to eg personal injury hazards). You should document the basis for your selected final isolation standard as part of your assessment record.

18 If you cannot achieve the baseline standard of isolation, you may need to alter the method of work, postpone the job or implement additional measures. **Where an option is available which will further reduce risk, this should always be used**.

Summary of considerations when using the selection tool

- It is not intended for use with:
  - pipelines;
  - 'high risk' situations (eg confined space entry);
  - extended term isolations.
- You should **always** challenge whether the output is compatible with common sense and professional judgement – particularly where input values lie close to category boundaries.
- Substance categories do not allow for all additional hazards associated with storage conditions – you may decide to default to a more hazardous substance category.
- If in doubt about the appropriate category to use (especially for substance category or location factor), you should err on the side of caution.
- The selection tool gives the **baseline** standard (usually this will be the minimum acceptable isolation standard). This is **not** always the most appropriate final isolation standard. You will need to ensure consideration of **all** relevant factors when selecting the final isolation.
- Use of a 'variation' (ie an isolation standard less than the baseline) may be acceptable in exceptional circumstances, eg for some short-term isolations.
- Record the basis for your decisions about isolation standards.
- The objective is not to meet/exceed the baseline standard, but to ensure that the risk associated with your isolation activity is both:
  - minimised to **ALARP**;
  - **tolerable**.

Typical examples

A pump in benzene (toxic/flammable) service has a maximum operating pressure of 20 barg. The suction flange is 40 cm. If a release occurs there is significant potential for escalation.

Substance = 1, 2 (CHIP categorisation: F, Carc Cat 1, T)
Release factor = H
Location factor = H
Outcome factor = A

Appropriate isolation standard: 1A = R
2A = R

Need for further consideration/risk assessment indicated. Conclusion may be eg that category I positive isolation is appropriate, or that it is not appropriate to work on live plant.

A pump in hydrocarbon/hydrofluoric acid (toxic/flammable) service has a maximum operating pressure of 12 barg. The suction flange is 30 cm. The numbers at risk are >10 and there is significant potential for escalation.

Substance = 1 (CHIP categorisation T+, C), 2
Release factor = H
Location factor = H
Outcome factor = A

Appropriate isolation standard: 1A = R
2A = R

Further consideration/risk assessment required. Conclusion likely to be either positive isolation or do not carry out work on live plant.

A very high pressure (>100 barg) steam boiler circulating pump is occasionally isolated for maintenance. The suction flange is 30 cm. Congested equipment, >10 at risk.

Substance = 2
Release factor = H
Location factor = H
Outcome factor = A

Appropriate isolation standard: 2A = R

Need for further consideration/risk assessment indicated. In these circumstances the risk to workers may be such that work on live plant is inappropriate.

A pump in liquid butane (LPG) service with a maximum operating pressure of 15 barg and suction line size of 10 cm is isolated for maintenance occasionally.

Substance = 2 (CHIP categorisation F+)
Release factor = M
Location factor = H
Outcome factor = B

Appropriate isolation standard: 2B = I

Baseline isolation is category I, positive isolation.

A section of 25 cm fire water main (3 barg 'jockey' pressure) in a tank farm area (1-2 at risk) has to be isolated annually to change out some hydrant valves.

Substance = 5
Release factor = M
Location factor = L
Outcome factor = C

Appropriate isolation standard: 5C = III

Baseline isolation is category III, single or double valve, no bleed.

A section of an 20 cm steam line carrying superheated steam at 15 barg and 300ºC requires isolating to permit a branch to be welded into the line.

Substance = 2
Release factor = M
Location factor = M
Outcome factor = B

Appropriate isolation standard: 2B = I

<u>Baseline</u> isolation is category I, positive isolation. Risk assessment may indicate that risk to workers is such that plant shutdown is appropriate.

Isolation of a 10 cm gasoline line at 10 barg and 20ºC in a tank farm manifold where one or two workers might be present.

Substance = 2 (may also be category 1, depending on CHIP classification)
Release factor = L
Location factor = M
Outcome factor = C

Appropriate isolation standard: 2C = II
1C = I

<u>Baseline</u> isolation is category I, positive isolation, or category II, proved isolation, depending on CHIP classification for carcinogenicity.

Isolation of a 30 cm methane line at >50 barg for the overhaul of regulator equipment.

Substance - 2 (CHIP classification)
Release factor - H
Location factor - M
Outcome factor - B

Appropriate isolation standard: 2B = I

<u>Baseline</u> isolation standard is positive isolation. Risk assessment may indicate that for short duration, manned operations it is appropriate to use proved isolation, with appropriate procedural controls.