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A comparison between mono-wall body and multi-wall body structures for a large scale metal cask

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Introduction

There are two types of cask bodies;

- Mono-wall type
  consisting of only an inner shell (forging)
- Multi-wall type,
  consisting of an inner shell, lead (gamma shielding) and an intermediate shell

The merits and demerits of each body type on;

- Safety requirement
  (1) Structural design strength,
  (2) Heat removal design and
  (3) Shielding design,
- Fabrication
- Economical standpoints

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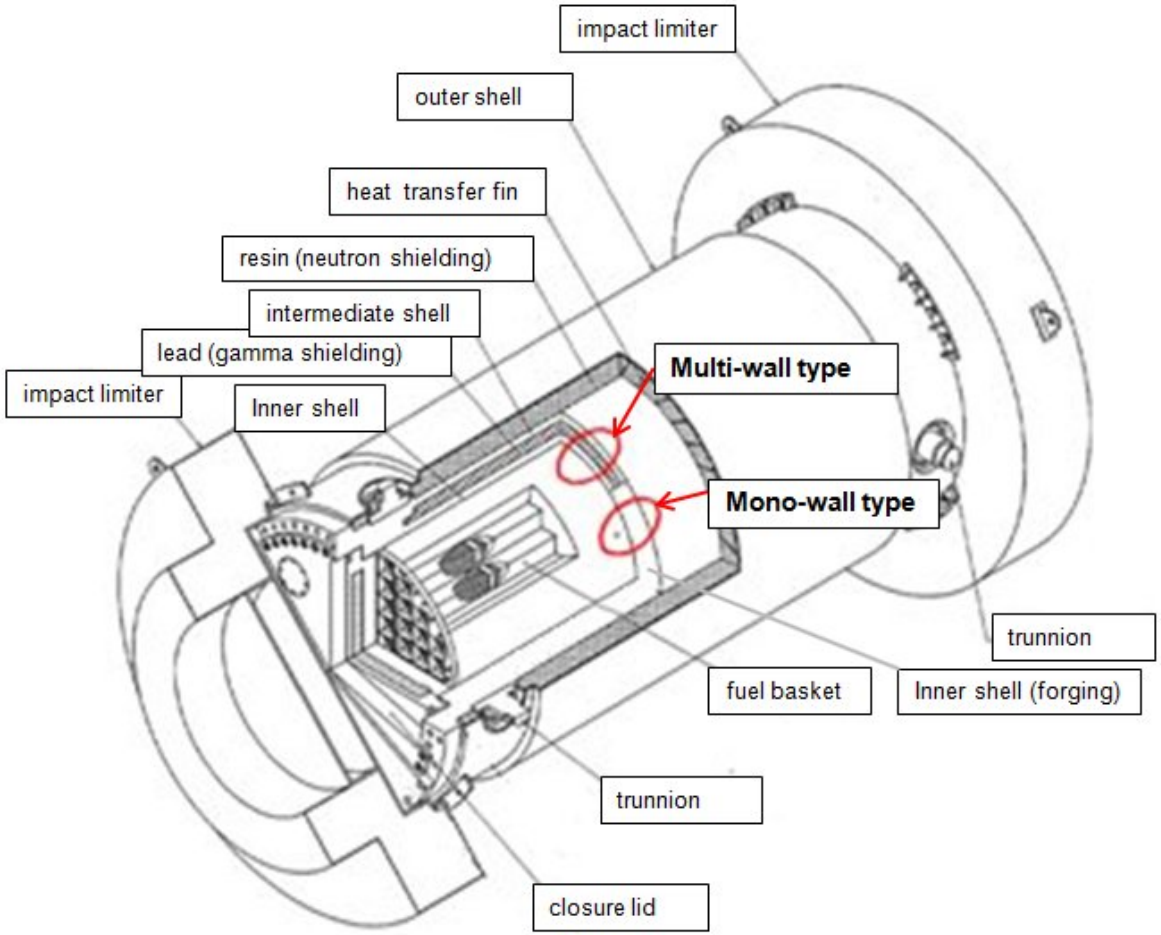
Cask structure and structural strength



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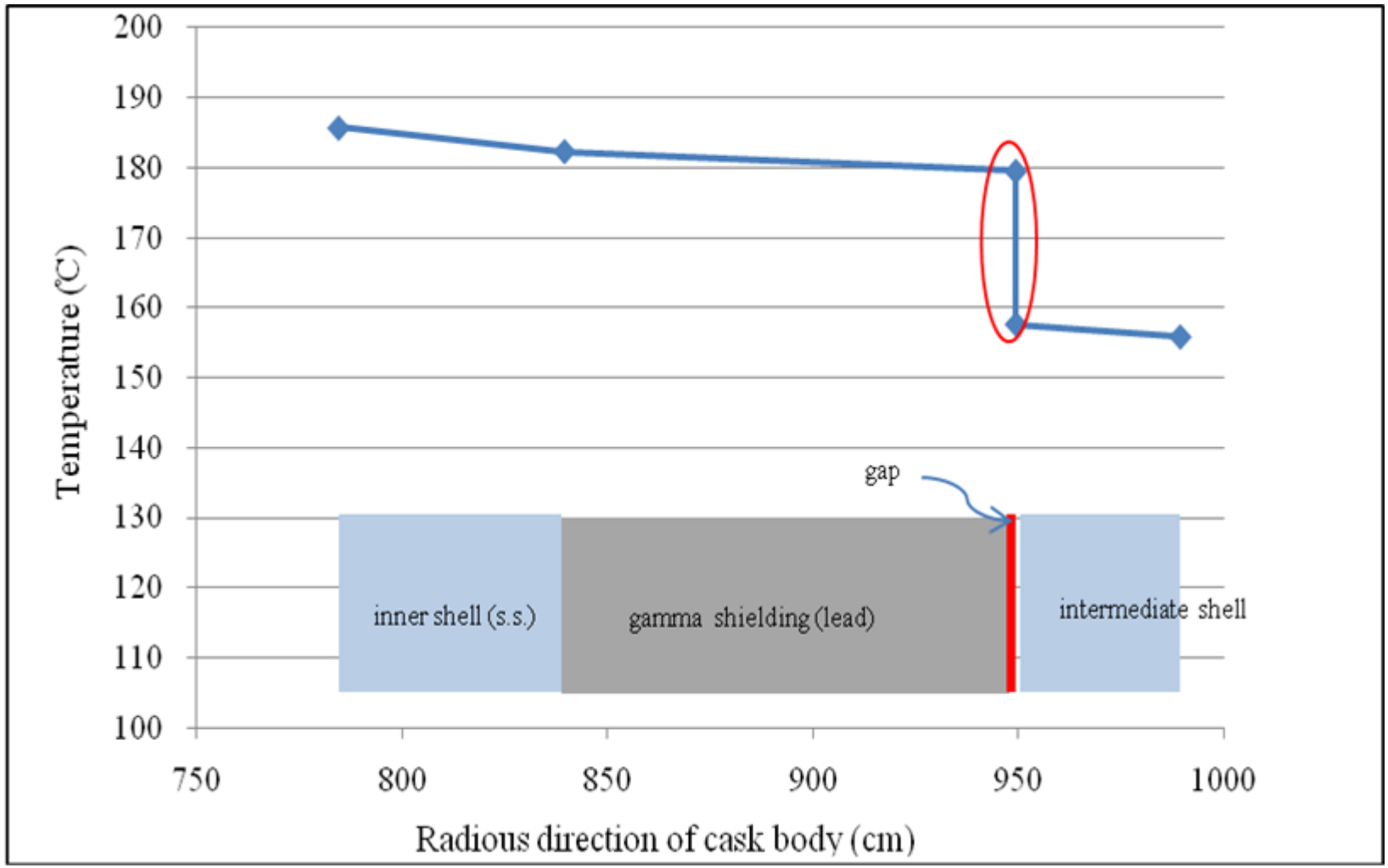
Heat Removal Performance:

Temperature distributions in the multi-wall type body



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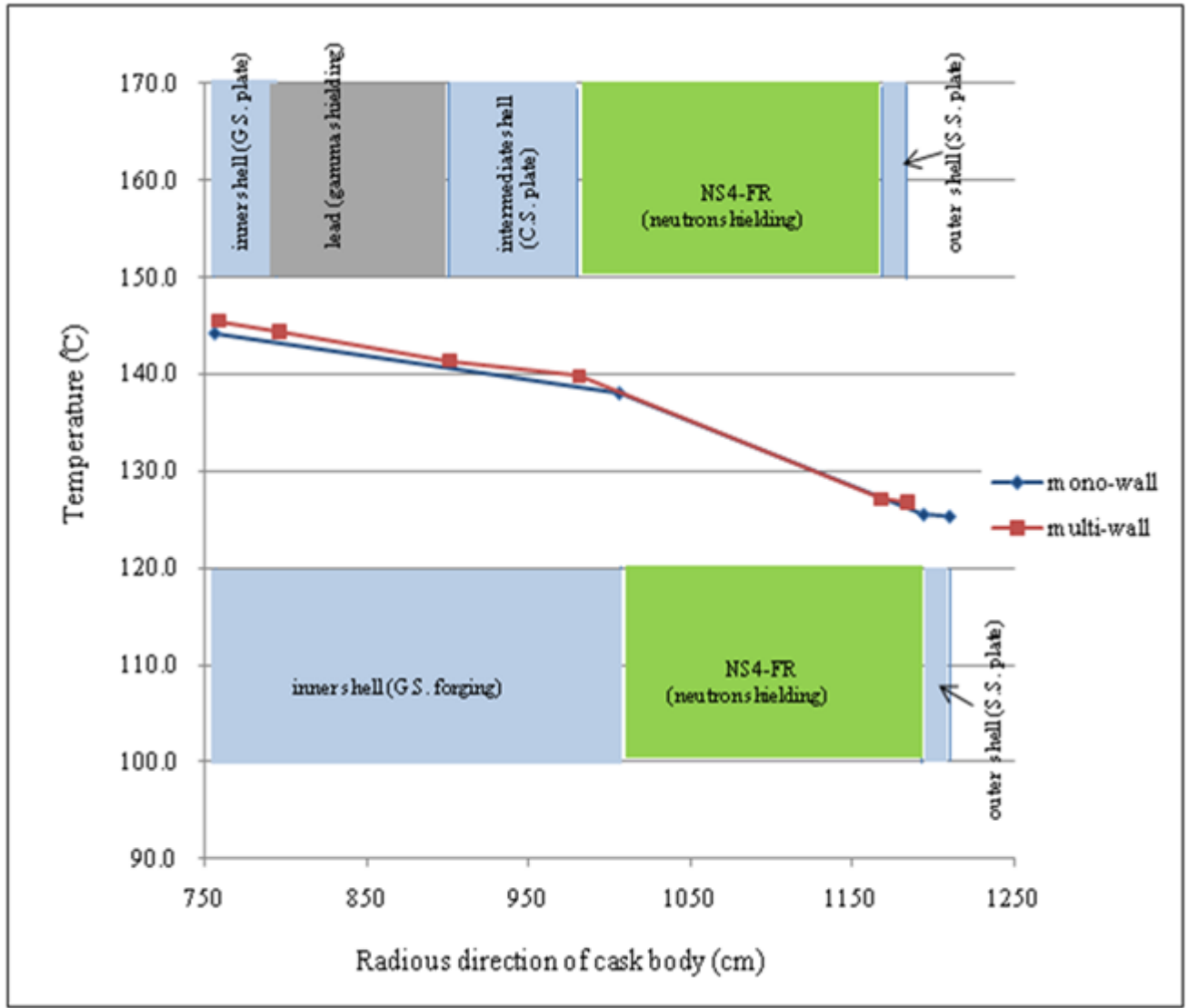
Heat Removal Performance:

Temperature distributions

-the mono-wall and the multi-wall with lead bonding-



More detail of Lead Bonding:

Go toT25

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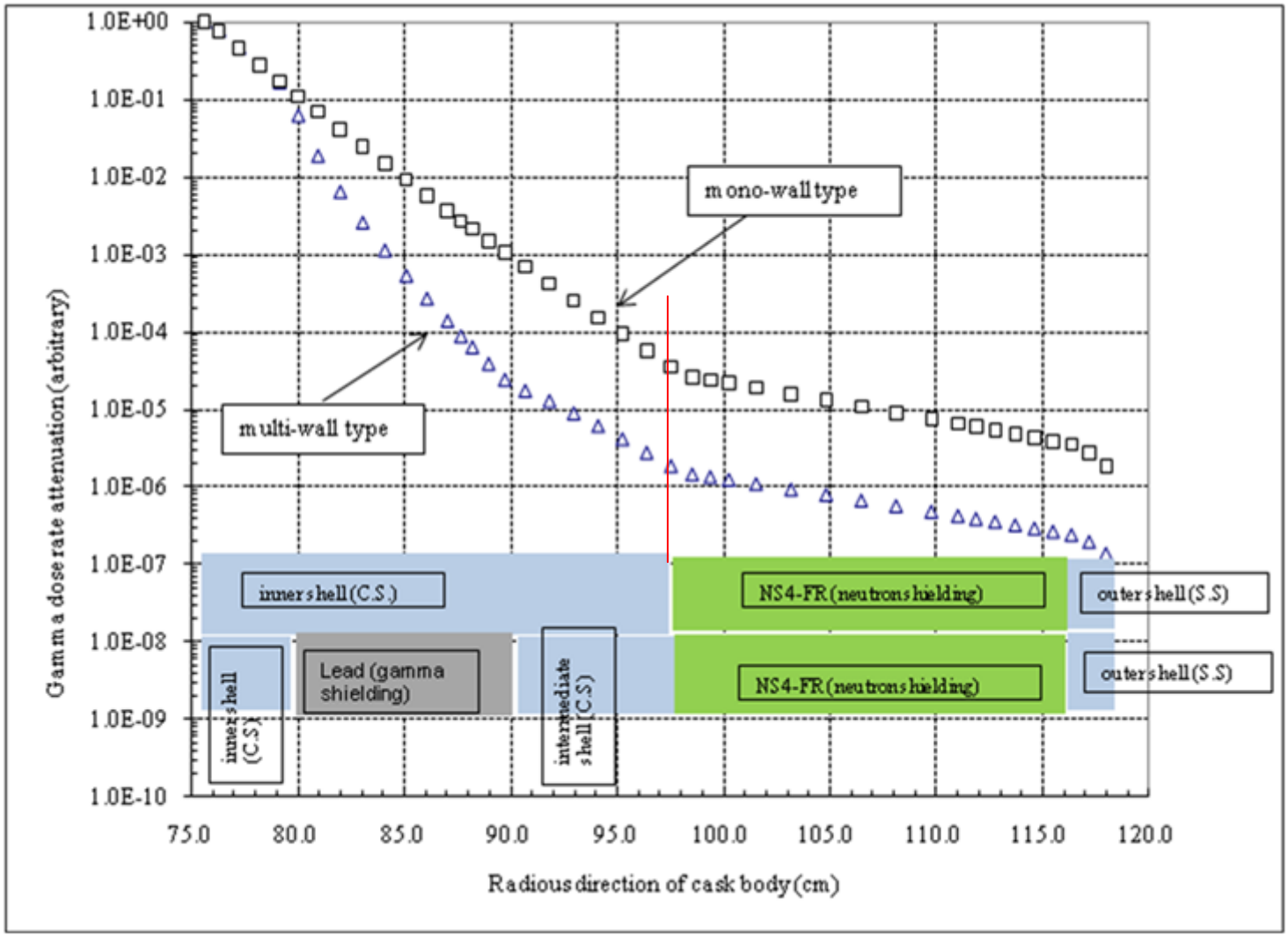
Shielding Performance:

gamma dose rate attenuation, -the mono-wall and the multi-wall-



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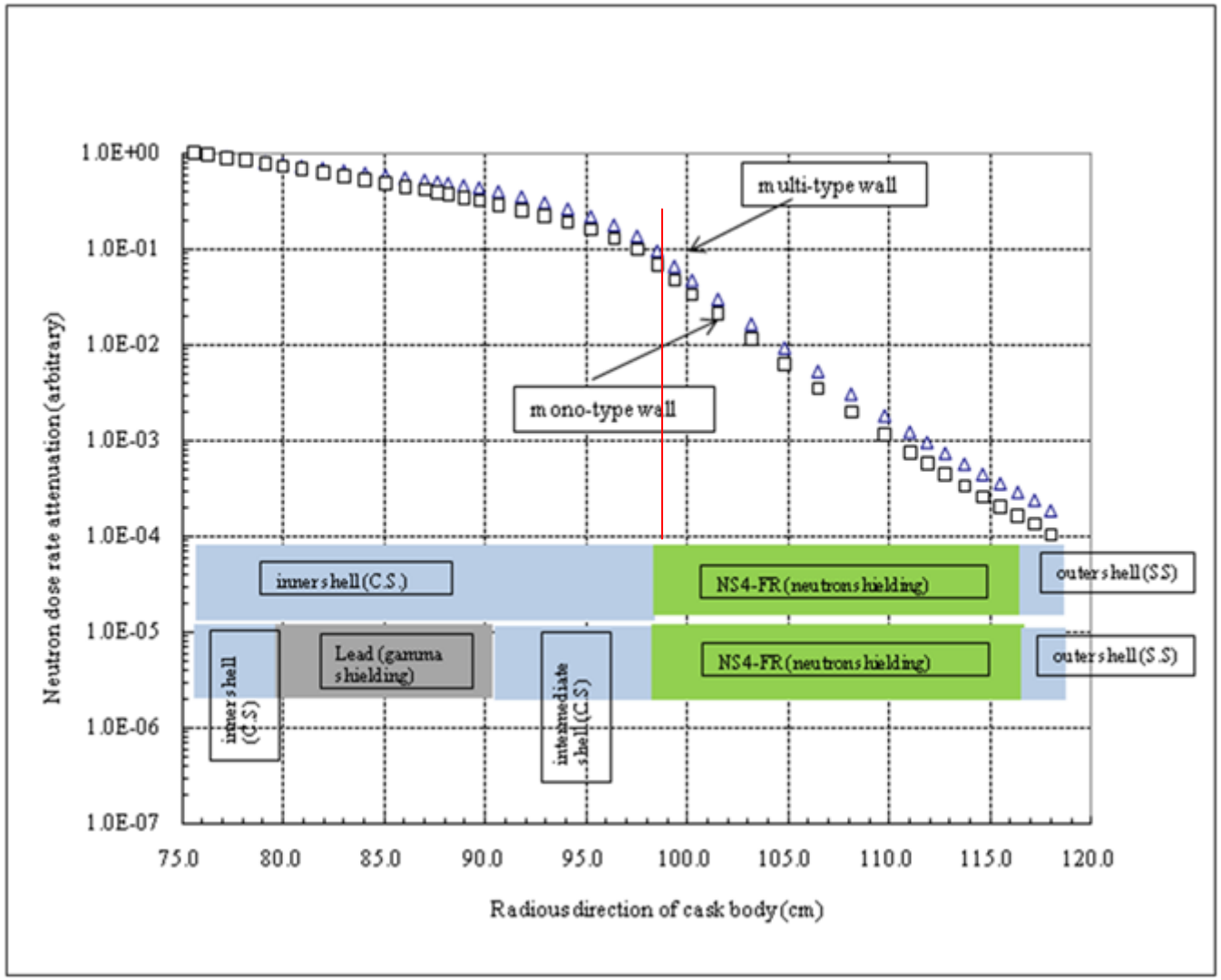
Shielding Performance:

neutron dose rate attenuation, -the mono-wall and the multi-wall-



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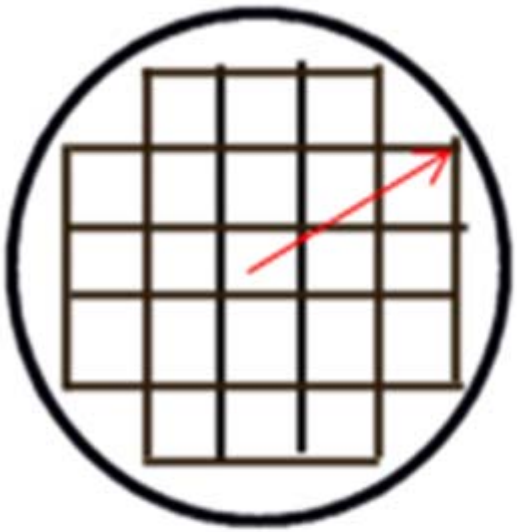
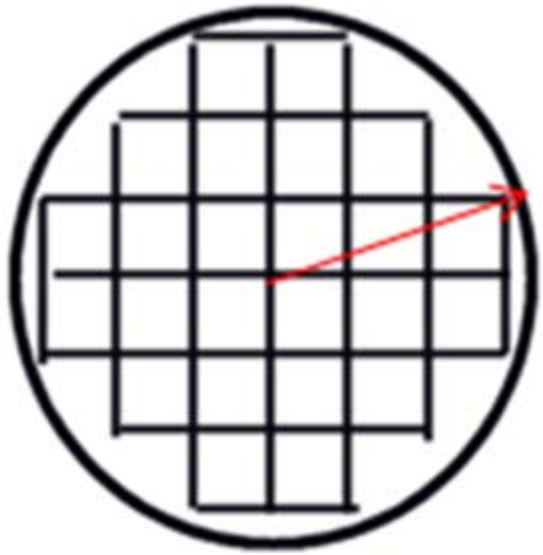
Shielding Performance:

Loading capacity consideration



21 Basket array
R=2.916*a=72.9 (cm)



24 Basket array
R=3.163*a=79.0 (cm)

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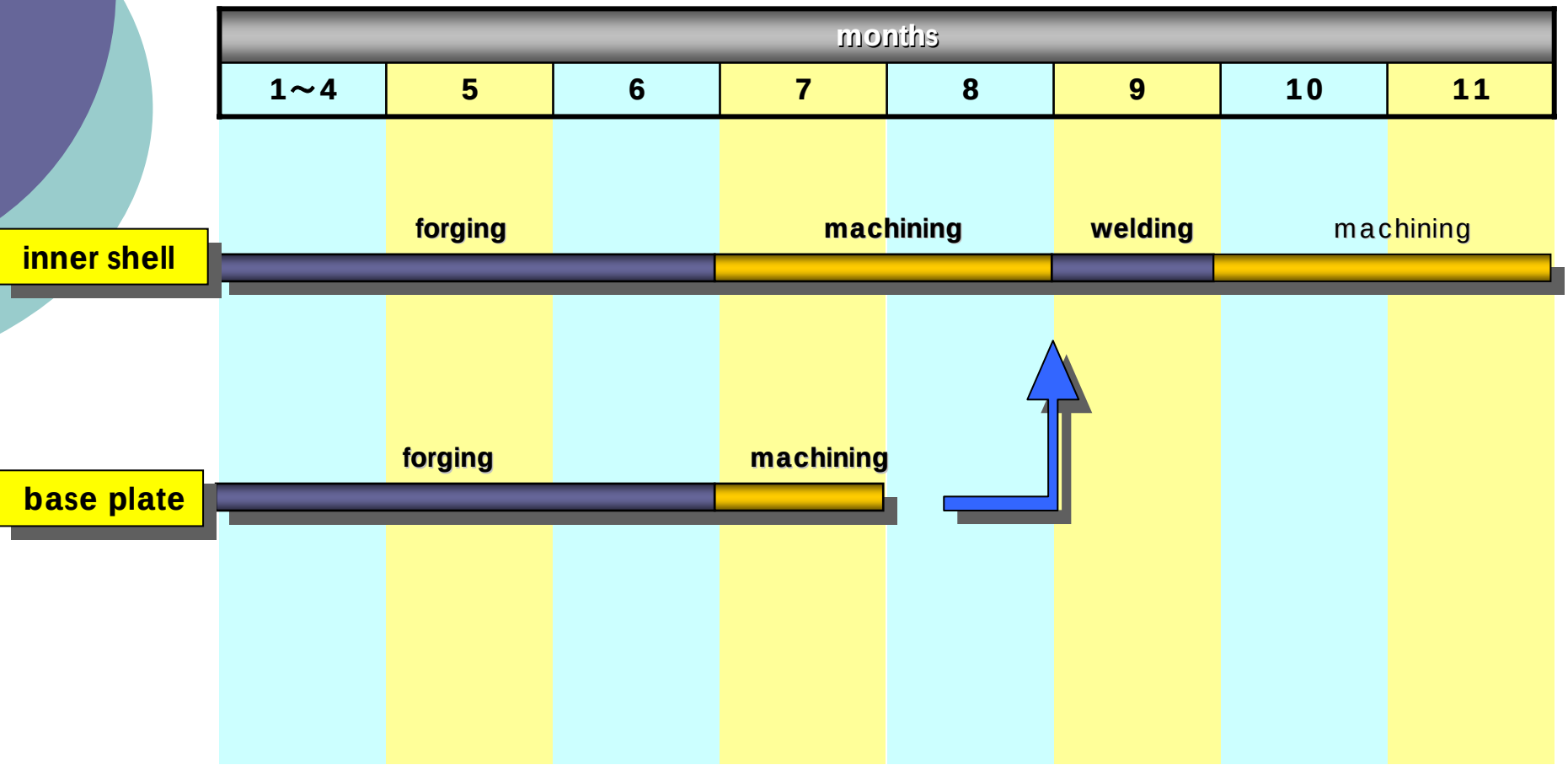
Fabrication:

Fabrication sequence diagram, -mono wall type-



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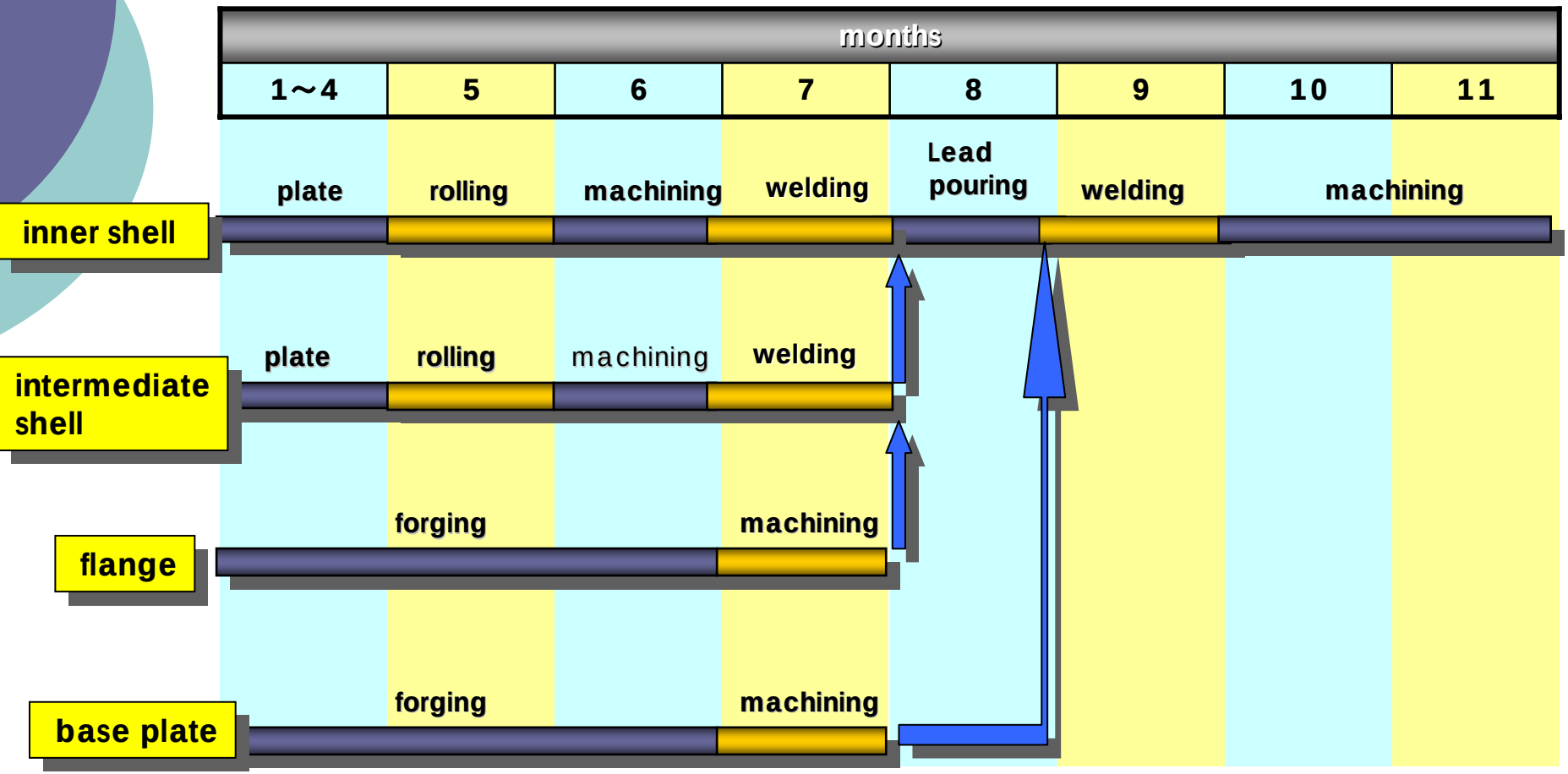
Fabrication:

Fabrication sequence diagram, -multi-wall type-



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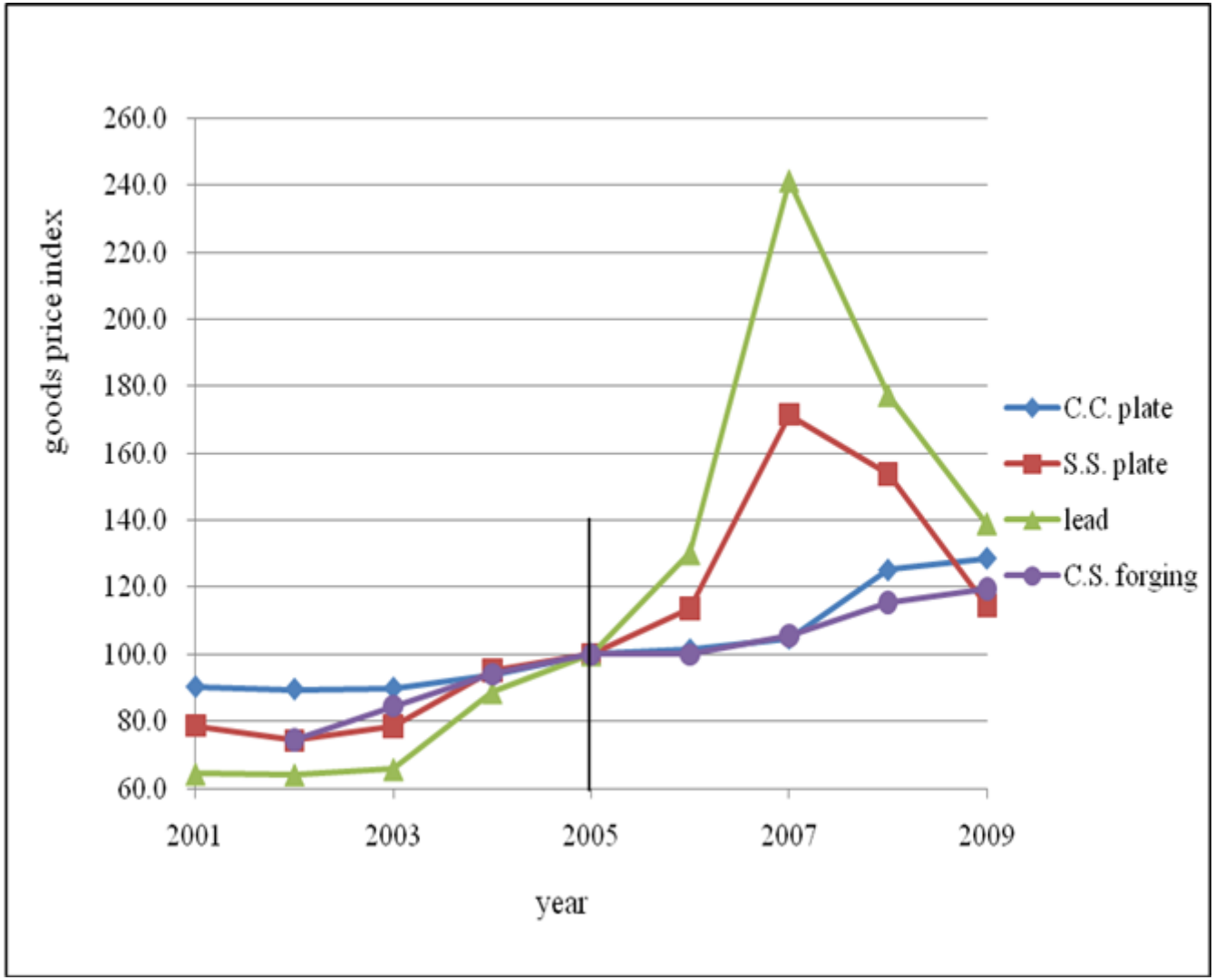
Consideration on Economy:

Goods price index, -forged material, carbon steel plates, stainless steel plates and lead



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Conclusion

Structural Performance:

Both types can be used as the cask main body structure.

Heat Removal Performance:

The mono-wall type is superior to the multi-wall type. Thermal resistance between the multi-wall type layers can be decreased by lead bonding.

Shielding Performance:

Multi-wall type is superior to the mono-wall type. Generally, loading capacity for the multi-wall type is larger.

Fabrication:

The supplying capacity of the mono-wall cask is limited compared to that of the multi-wall type.

Consideration on Economy:

Price fluctuations and the contribution of material costs ought to be considered. When large volumes of casks are procured at one time, the material supplying capacity becomes more important.