TABLE 1-continued

Summary of Data-144-Hr Irradiation of In-Core Mo Metal Powder; 8 g/cc, 2-cm Diameter

| Geometry | $^{99}$Mo Activity (Ci) | Activity (Ci/gm) | Cell Mass (g) |
|---|---|---|---|
| Fuel Annulus + Lead Reflector | 941.1 | 0.9854 | 955.04 |
| Fuel Annulus – Hydrogen | 728.1 | 0.7624 | 955.04 |
| Fuel Annulus – Hydrogen + Beryllium Reflector | 962.7 | 1.0080 | 955.04 |
| Fuel Annulus – Hydrogen + Lead Reflector | 830.2 | 0.8693 | 955.04 |

(a) These values are for the center of the core for a 3-cm-tall target; all other cases correctly average over the entire core height of 38 cm.
(b) The molybdenum annulus was 0.25 cm thick.

**[0067]** Referring to FIGS. **14** and **15**, example data demonstrating neutron flux is shown. Accordingly, FIG. **14** demonstrates a Log-Log plot superimposing the neutron flux of position D**8** in water with the cross section for $^{98}$Mo(n, gamma)$^{99}$Mo. The group average shows the integrated flux over the discrete **95** energy bins. FIG. **15** demonstrates a Log-Log plot superimposing the neutron flux of position D**8** in water (out-of-core) with center of the core (position D**5**) in the research reactor.

**[0068]** In accordance with example implementations, the irradiated target material can be processed utilizing the materials and/or methods described in US patent publication US2012/0106691 to Toth et al. entitled "Method and System for Radioisotope Generation", published May 3, 2012; the entirety of which is incorporated by reference herein.

**[0069]** In compliance with the statute, embodiments of the invention have been described in language more or less specific as to structural and methodical features. It is to be understood, however, that the entire invention is not limited to the specific features and/or embodiments shown and/or described, since the disclosed embodiments comprise forms of putting the invention into effect. The invention is, therefore, claimed in any of its forms or modifications within the proper scope of the appended claims appropriately interpreted in accordance with the doctrine of equivalents.

**1**. A target assembly comprising:
an annulus comprising uranium, and defining an outer diameter and an inner diameter, the inner diameter defining a volume within the annulus; and
target material within the volume of the annulus, the target material consisting essentially of non-uranium material.

**2**. The target assembly of claim **1** further comprising one or more reflector components arranged along a perimeter of the target material and/or annulus.

**3**. The target assembly of claim **2** wherein the one or more reflector components comprise beryllium (Be) or lead (Pb).

**4**. The target assembly of claim **2** wherein the one or more reflector components, in at least one cross section, defines a thickness less than about 5 cm.

**5**. The target assembly of claim **1** further comprising at least one liner arranged along the inner diameter of the annulus.

**6**. The target assembly of claim **5** wherein the at least one liner comprises one or more of boron, boron carbide, boron nitride, and cadmium.

**7**. The target assembly of claim **1** further comprising cladding over at least a portion of a surface of one or both of the annulus and/or target material.

**8**. The target assembly of claim **7** wherein the cladding comprises zirconium,(Zr), zircalloy and/or stainless steel.

**9**. The target assembly of claim **1** wherein the annulus comprises uranium having an enrichment of $^{235}$U of less than about 20%.

**10**. The target assembly of claim **1** wherein the annulus comprises an alloy of uranium and erbium.

**11**. The target assembly of claim **1** wherein the annulus comprises $UZrH_x$.

**12**. The target assembly of claim **1** wherein the target material comprises at least one of Mo, P, S, Ir, Au, Re, and/or Cr.

**13**. The target assembly of claim **1**, wherein said annulus and target material are disposed within a can wall.

**14**. The target assembly of claim **1** configured as an element to be coupled with a plurality of other elements in a single assembly.

**15**. The target assembly of claim **1** wherein the annulus is configured to be removably coupled to the target material.

**16**. The target assembly of claim **1** wherein in at least one cross section the distance between the inner and outer diameter of the annulus is from about 100 μm to about 1 cm.

**17**. The target assembly of claim **1** wherein the annulus defines a length extending between opposing openings to the volume, the length being less than about 38 cm.

**18**. The target assembly of claim **1** wherein the target occupies an entirety of the volume defined by the annulus in at least one cross section.

**19**. The target assembly of claim **18** further comprising at least one liner arranged along the inner diameter of the annulus, the annulus and liner defining the volume, and the target occupying an the entirety of the volume in the at least one cross section.

**20**. The target assembly of claim **18** further comprising cladding over at least a portion of a surface of one or both of the annulus and/or target material wherein, the target occupying an the entirety of the volume in the at least one cross section.

**21**. A reactor comprising:
one or more discrete zones configured to receive target material; and
at least one uranium-comprising annulus individually within the one or more discrete zones, the annulus defining an outer diameter and an inner diameter, the inner diameter defining a volume within the annulus, the volume configured to receive the target material within an entirety of the volume in at least one cross section.

**22**. The reactor of claim **21** wherein the annulus is removable from the reactor.

**23**. The reactor of claim **21** wherein at least one of the discrete zones is located outside of a core of the reactor.

**24**. The reactor of claim **21** further comprising one or more reflector components arranged along the perimeter of the target material and/or annulus.

**25**. The reactor of claim **21** further comprising one or more liners associated with the inner diameters of the annulus.

**26**. The reactor of claim **21** further comprising:
one or more reflector components arranged along the perimeter of the target material and/or annulus; and
one or more liners associated with the outer and/or inner diameters of the annulus.

**27**. The reactor of claim **26** wherein:
the one or more reflector components comprise beryllium or lead (Pb); and