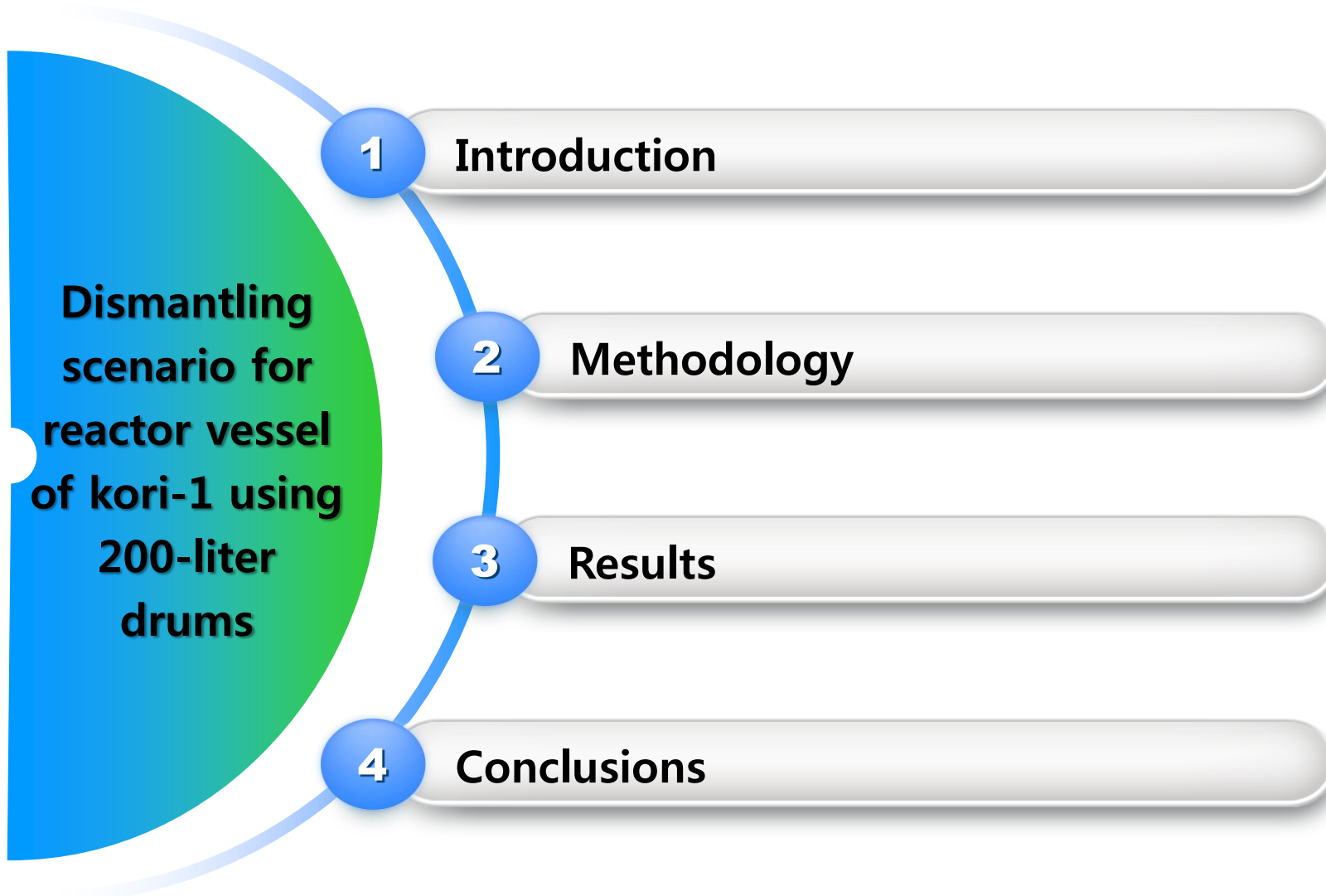


Dismantling scenario for reactor vessel of kori-1 using 200-liter drums

2016. 5. 13.



Contents



An hourglass with a wooden top and bottom and a glass body, set against a background of a sunset over water. A white rounded rectangular frame is overlaid on the hourglass. Inside the frame, a green semi-circle is on the left, containing the number '1'. The word 'Introduction' is written in yellow in the center of the frame.

1

Introduction



■ 국내 방사성 폐기물 저장 시설 현황

- 한국원자력환경공단(Korea Radioactive Waste Agency)
 - 1단계 동굴처분 시설은 2015년에 준공
 - 2단계 표층처분 시설은 2019년에 완공 예정



폐기물 처분 시설 현황

처분 방식	수용 용량
동굴 처분	10,000
표층 처분	125,000

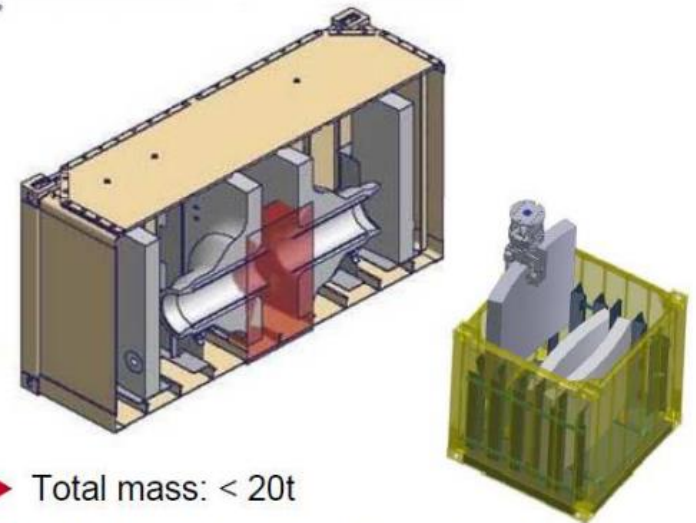
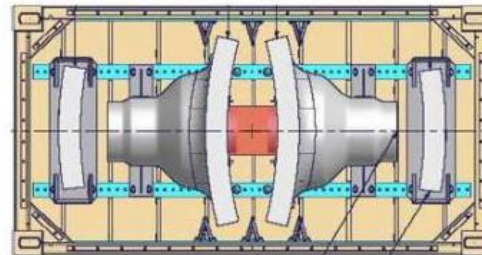
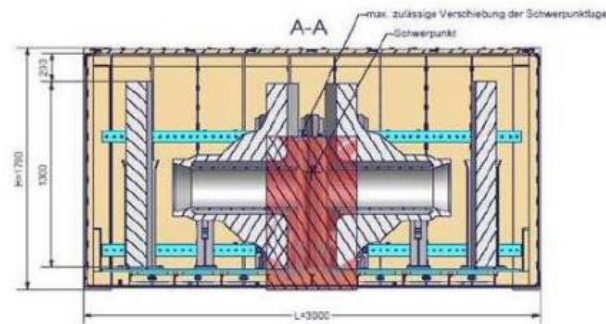
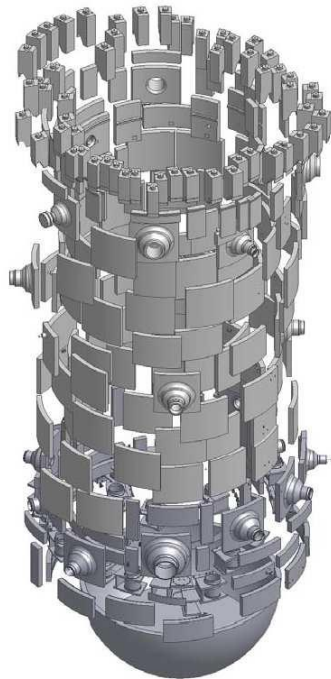
200ℓ 드럼 기준

**현재 200 ℓ 드럼 외
인수 기준 없음**

■ 원자로압력용기 해체 시나리오 수립

■ 폐기물 저장용기가 가장 큰 변수

- 고리 1호기에 대해 200ℓ 드럼 기준 해체 시나리오 수립 필요



▶ Total mass: < 20t

▶ Difference in center of gravity: < 10%

Wuergassen NPP (BWR) Reactor Vessel Segmentation and Package

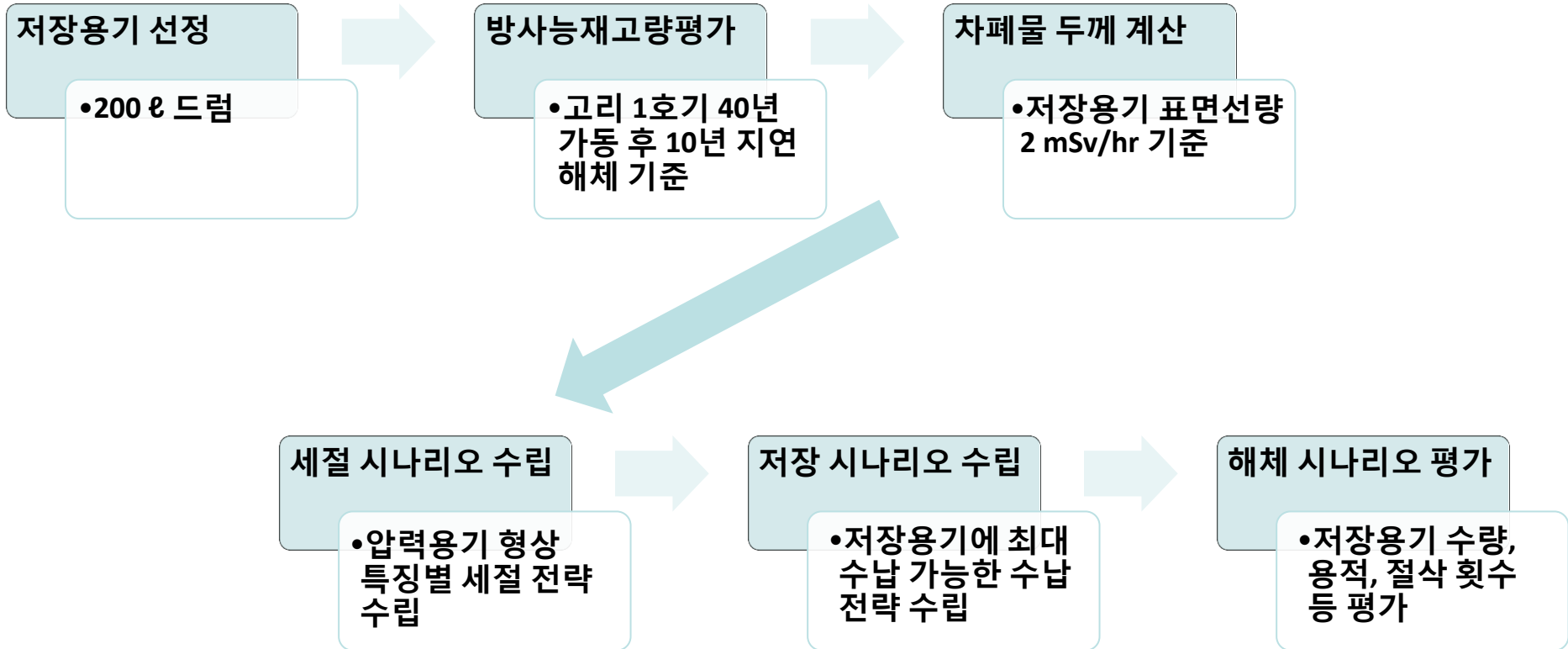
An hourglass with a wooden top and bottom and a glass body, set against a background of a sunset over water. A white rounded rectangular frame is overlaid on the hourglass, containing a green semi-circle on the left and the word 'Methodology' in the center. The number '2' is on the green semi-circle.

2

Methodology



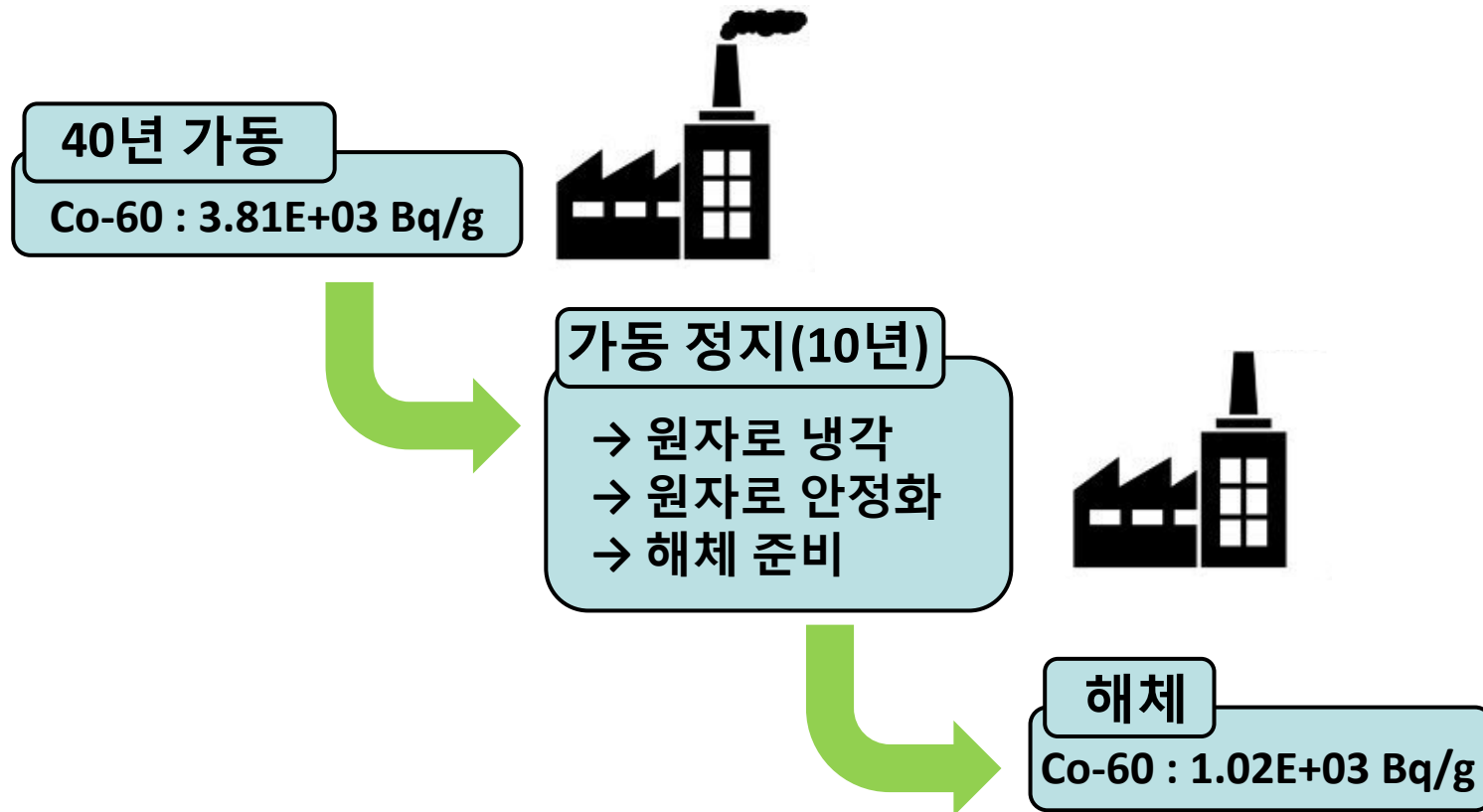
■ 원자로압력용기 해체 시나리오 수립 전략





■ Co-60¹ 방사능 재고량 평가 (문헌자료² 참조)

- 40년 가동한 고리1호기의 방사능 재고량을 계산
- 10년 지연 시 방사능 재고량 변화 계산

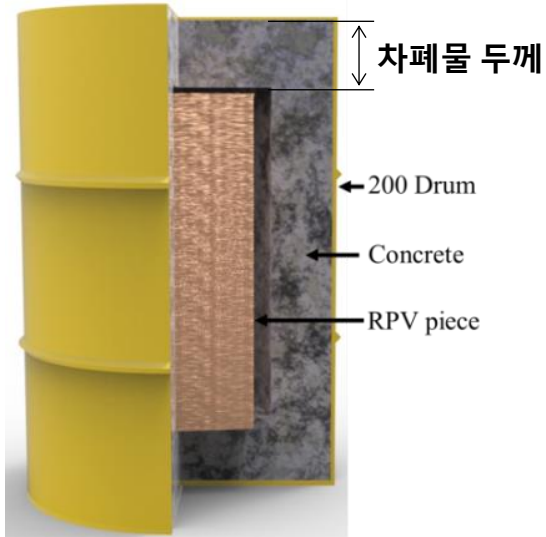


1. Co-60 은 감마선 방출체로 작업자의 외부피폭에 주된 영향을 미침
2. Seong-Hwa Shin. (2003), Neutron activation analysis of reactor pressure vessel.

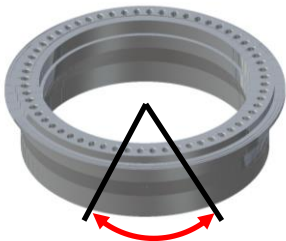


■ 차폐물 두께 계산

- 압력용기 세절 조각이 수납되었을 때 저장용기의 표면선량이 2mSv/h이하인 차폐물 두께를 계산



200 L 드럼 구조



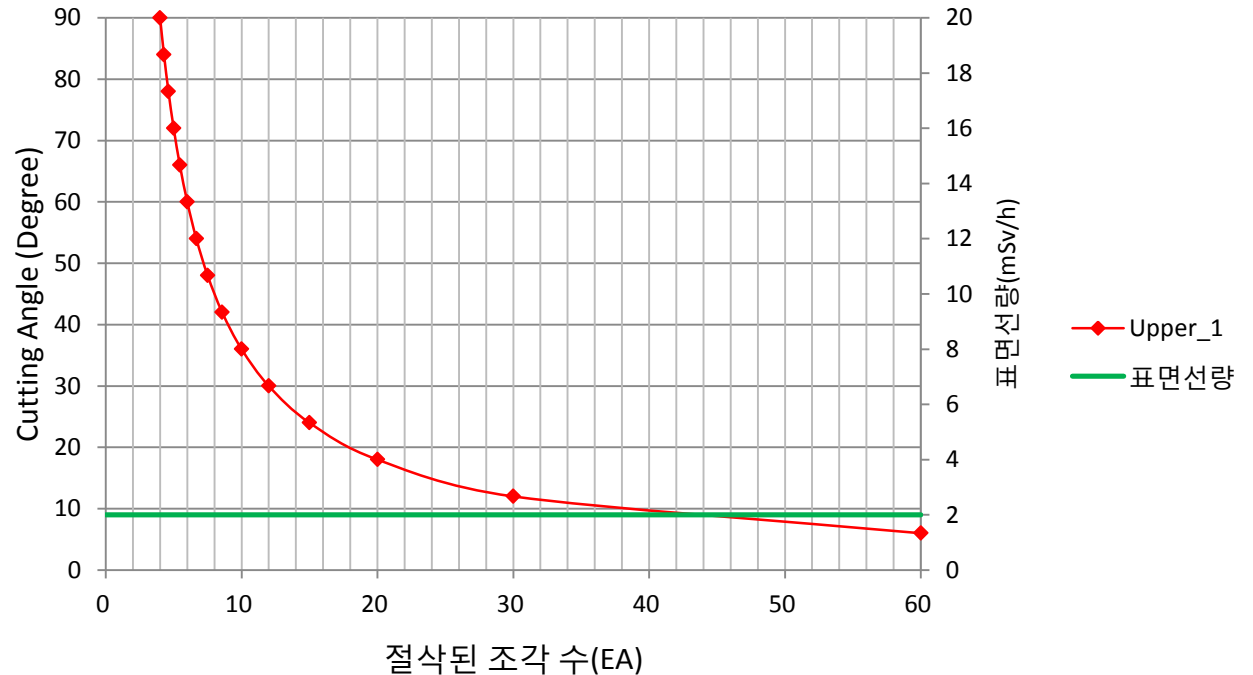
Cutting angle

원자로압력용기 절삭

MCNP Parameters

방사능 재고량	Co-60 : 1.02E+03 Bq/g
드럼 재질	철
차폐물	콘크리트

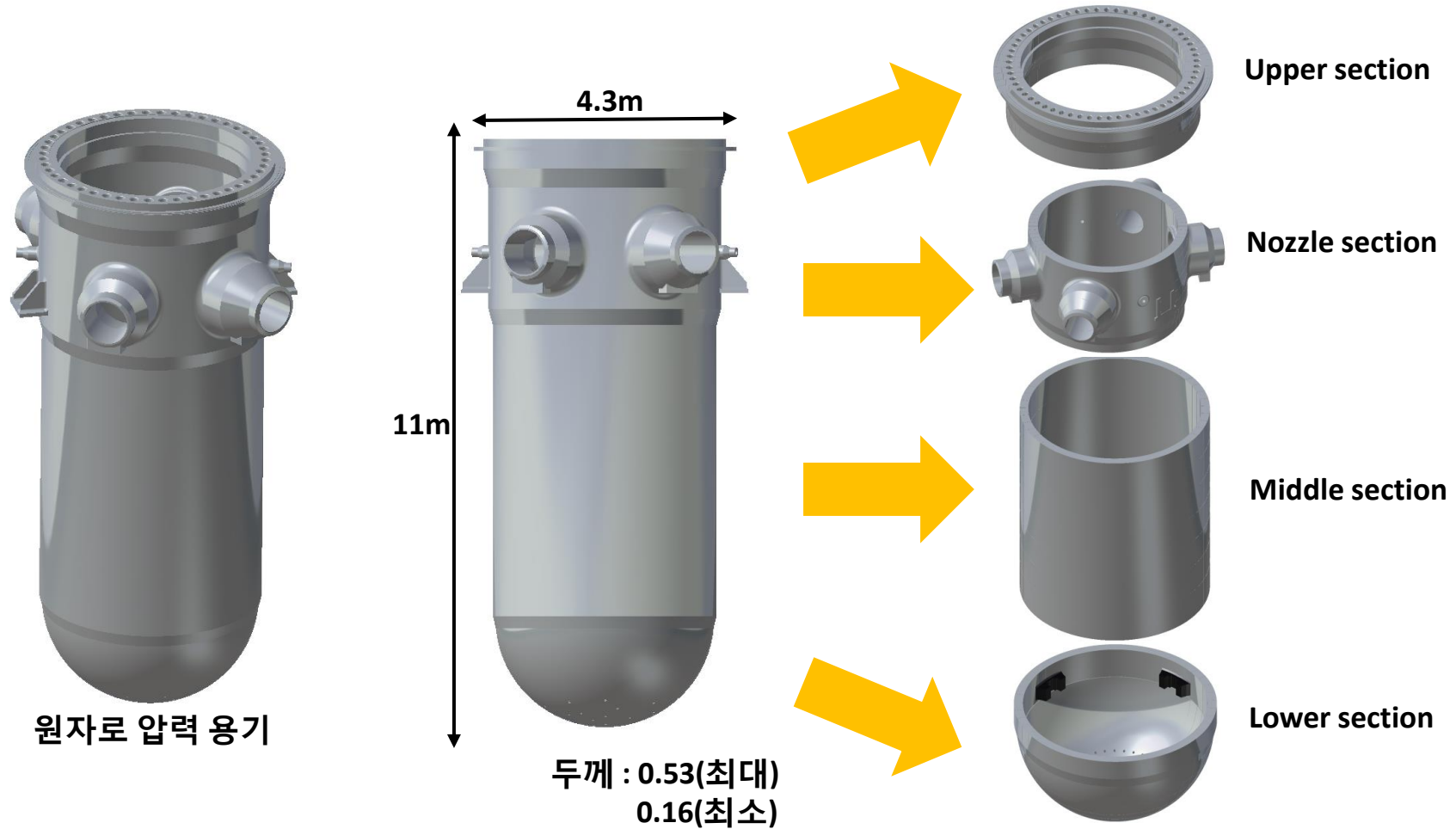
Upper_1 최적 Cutting Angle





■ 세절 시나리오 수립

- 원자로압력용기 각 부분의 형상 특징에 따라 다른 세절 전략 수립



An hourglass with a wooden top and bottom and a glass body, set against a background of a sunset over water. A white rounded rectangular frame is overlaid on the hourglass, containing a green semi-circle on the left and the word 'Results' in the center. The number '3' is on the green semi-circle.

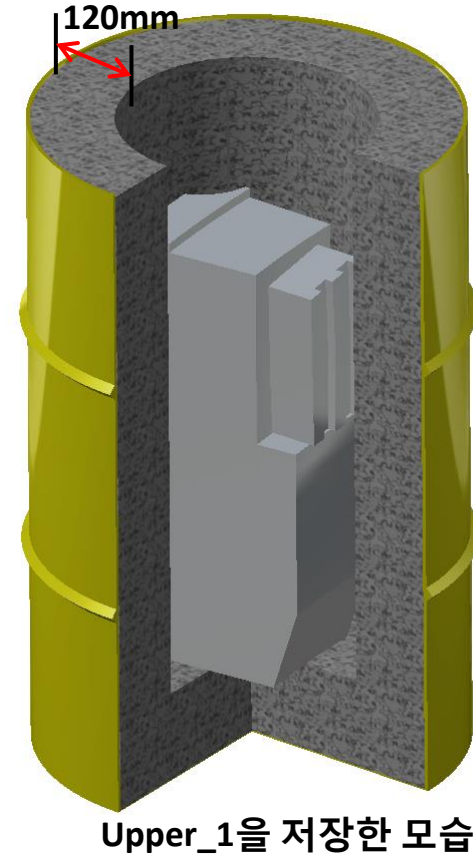
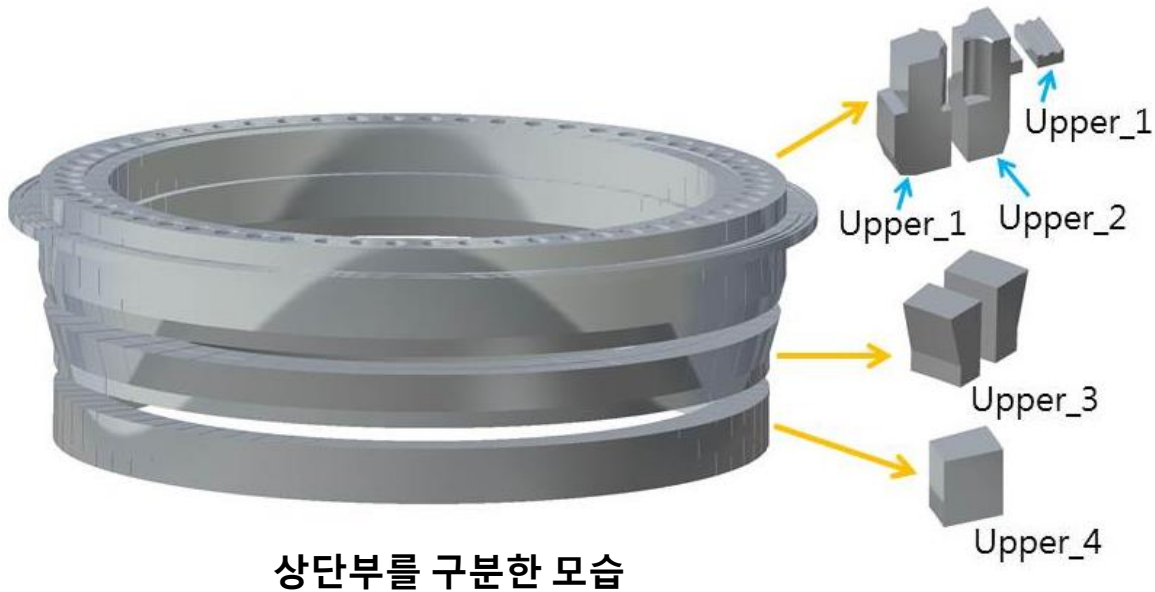
3

Results



■ 상단부

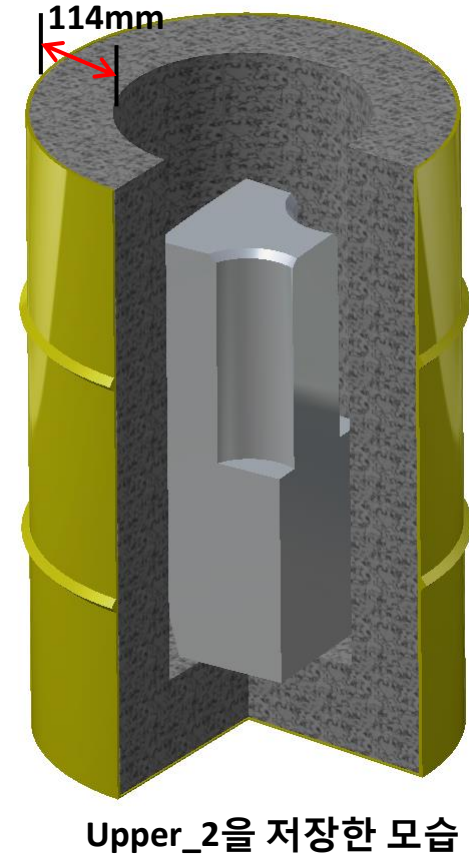
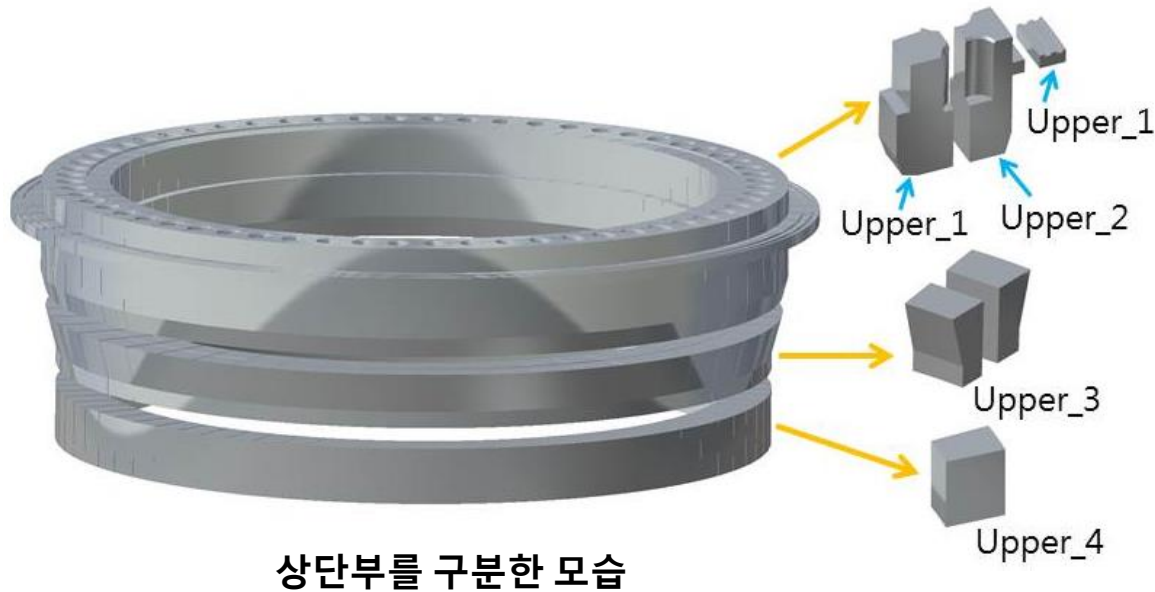
- Geometry에 따라 상단부를 4부분으로 구분하고 절삭을 함





■ 상단부

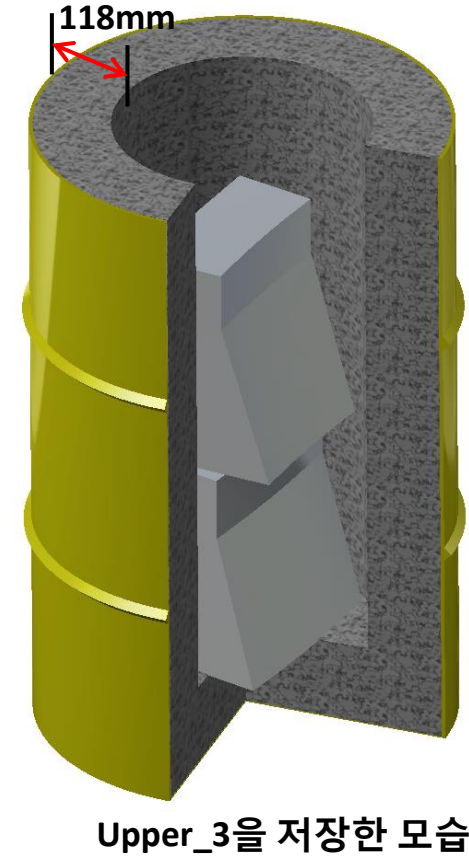
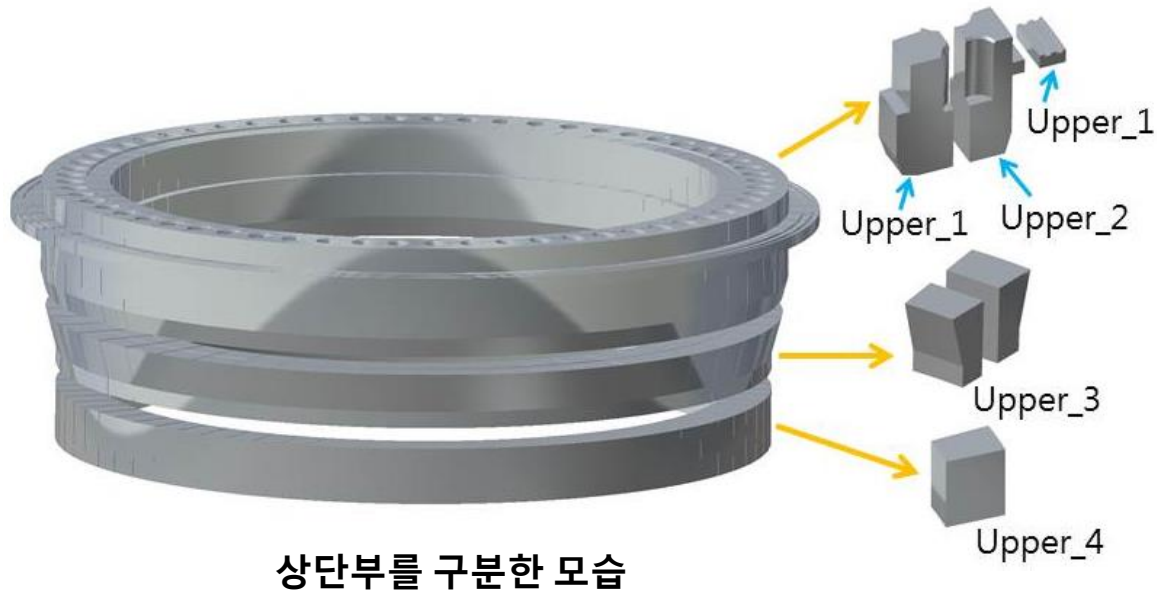
- Geometry에 따라 상단부를 4부분으로 구분하고 절삭을 함





■ 상단부

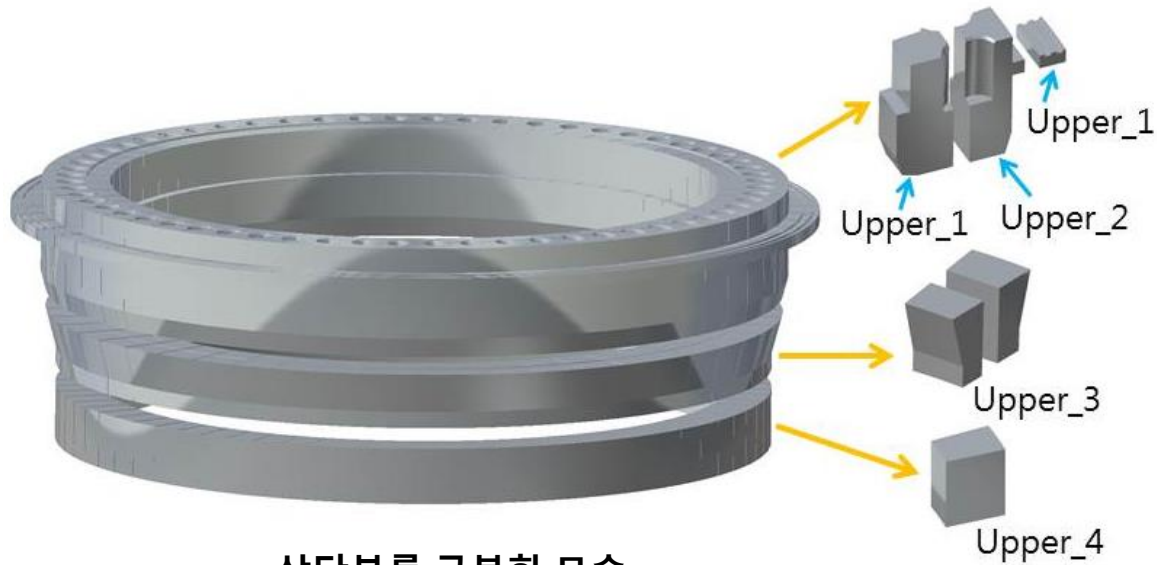
- Geometry에 따라 상단부를 4부분으로 구분하고 절삭을 함



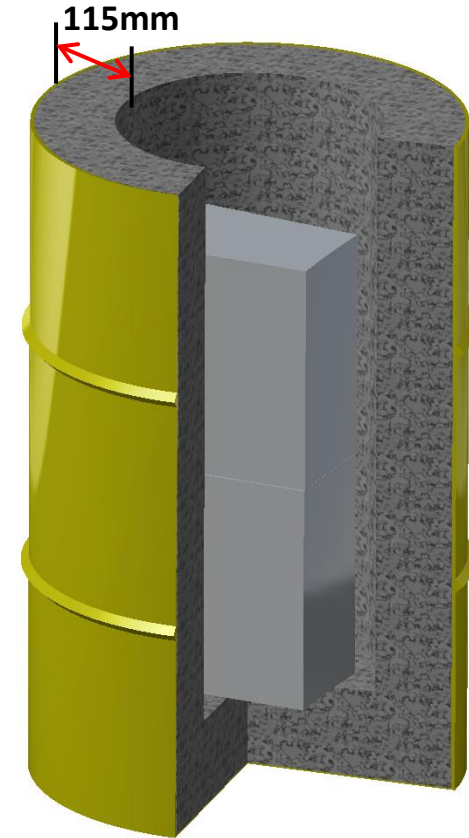


■ 상단부

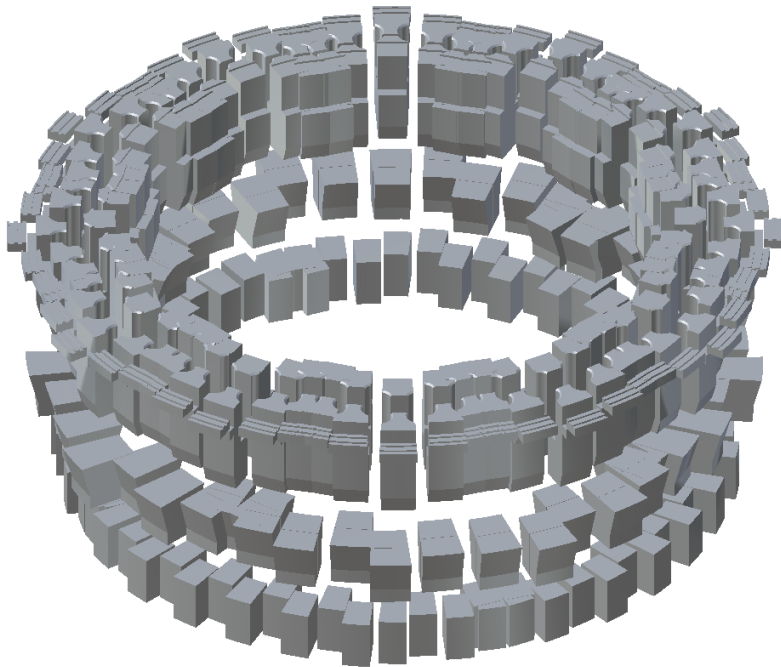
- Geometry에 따라 상단부를 4부분으로 구분하고 절삭을 함



상단부를 구분한 모습



Upper_4을 저장한 모습



상단부를 절삭한 모습

상단부 절삭 결과

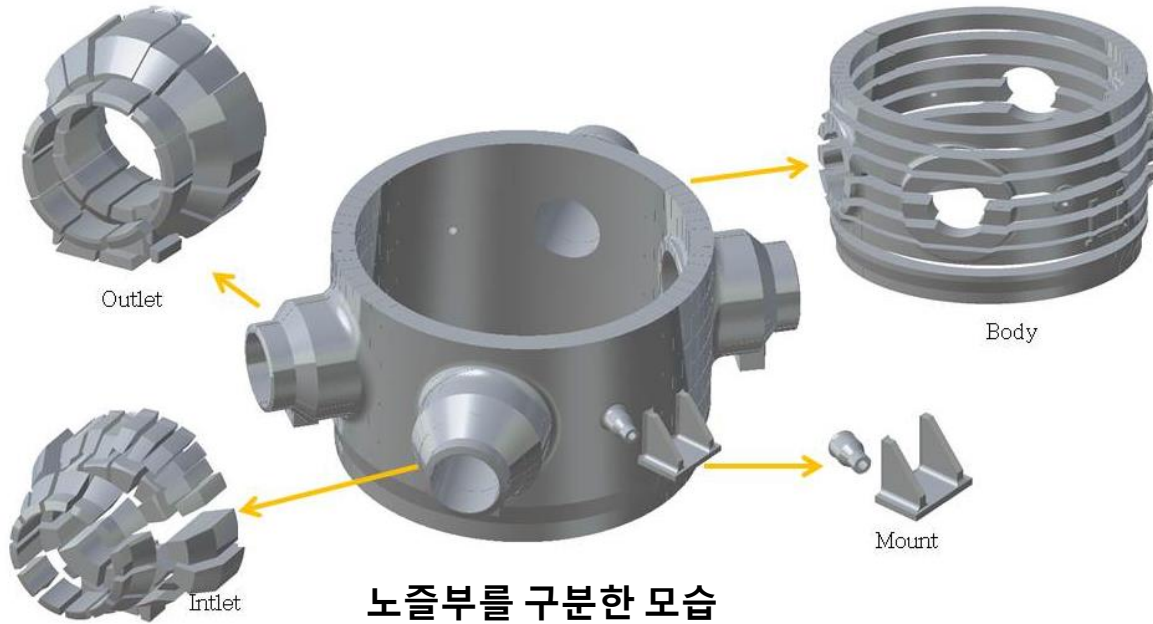
	Cutting angle (deg)	Cutting height (mm)	Thickness of shield (mm)	Number of cutting	Total of drum (1drum*)
Upper_1	6	595	120	121	60(2)
Upper_2	6	595	114	61	60(1)
Upper_3	8	300	118	81	40(2)
Upper_4	5	300	115	72	36(4)
Total				336	196

*1드럼에 들어가는 절단된 조각 수



■ 노즐부

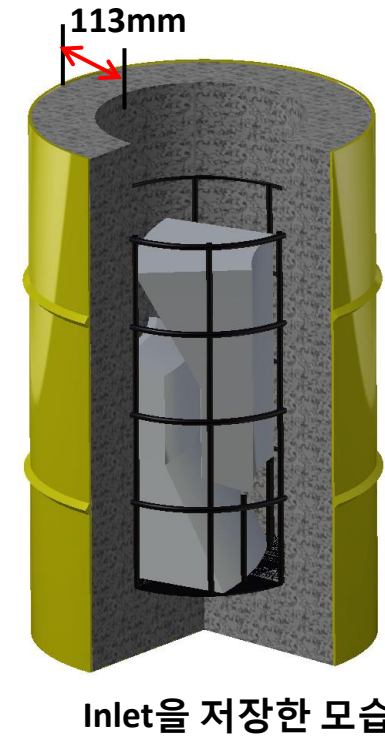
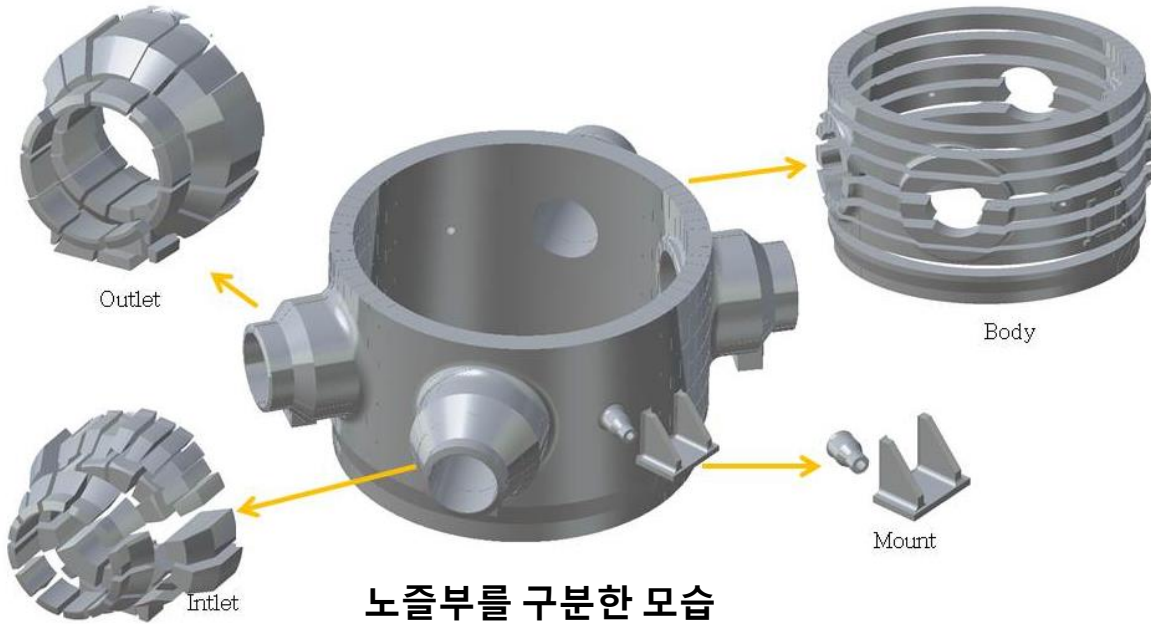
- Geometry 에 따라 Inlet, Outlet, Mount 및 Body로 구분 후 절삭을 함





■ 노즐부

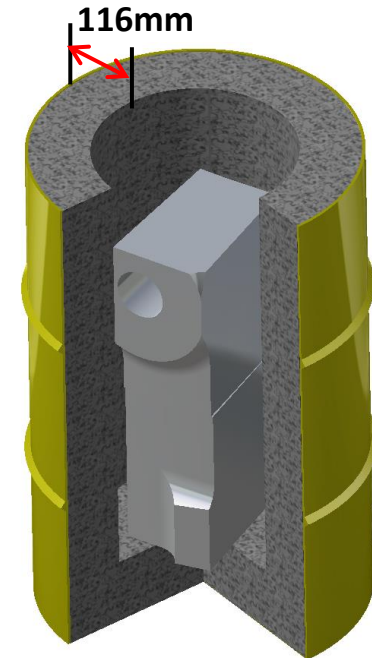
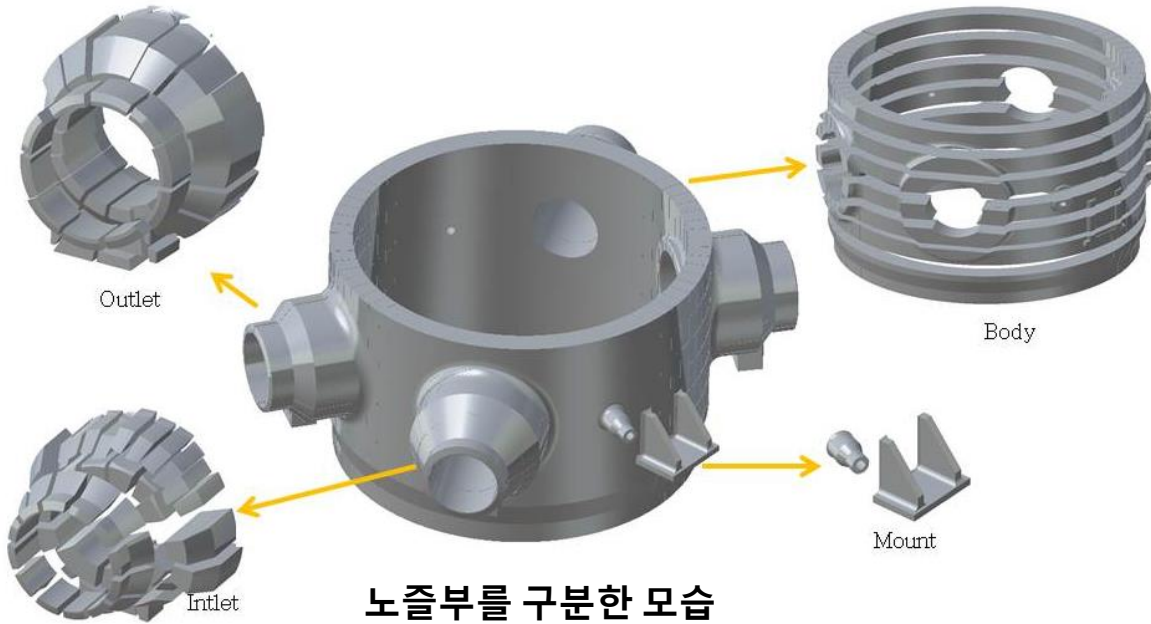
➢ Geometry 에 따라 Inlet, Outlet, Mount 및 Body로 구분 후 절삭함



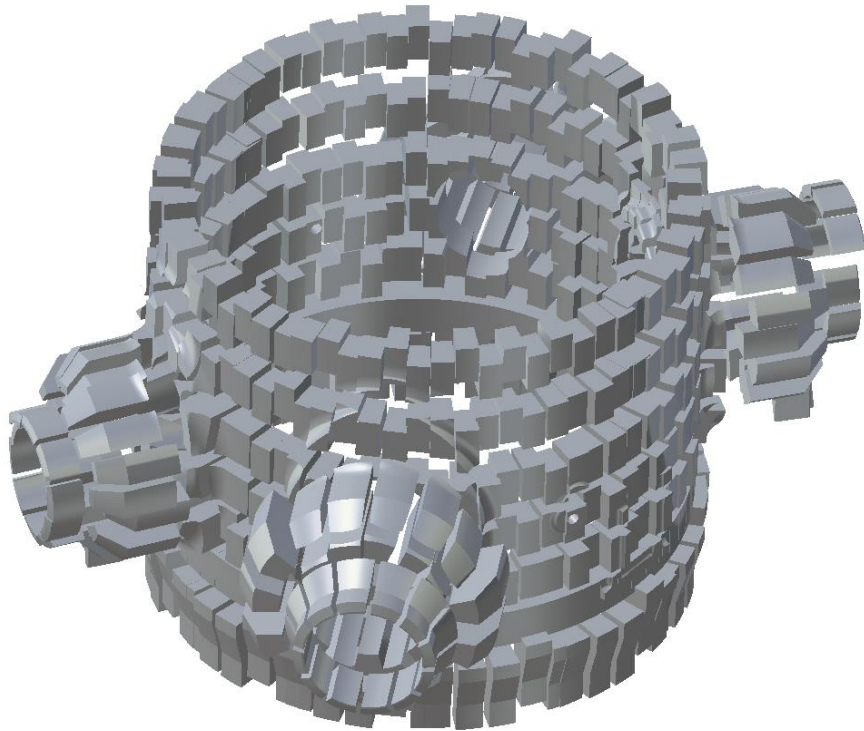


■ 노즐부

- Geometry 에 따라 Inlet, Outlet, Mount 및 Body로 구분 후 절삭함



Body을 저장한 모습



노즐부를 절삭한 모습

노즐부 절삭 결과

	Cutting angle (deg)	Thickness of shield (mm)	Number of cutting	Total of drum (1drum)
Inlet	12,24,30	112~121	114	48
Outlet	24,30	113~118	80	42
Mount	-	113~116	10	5
Body	5	112~120	526	226
Total			730	321

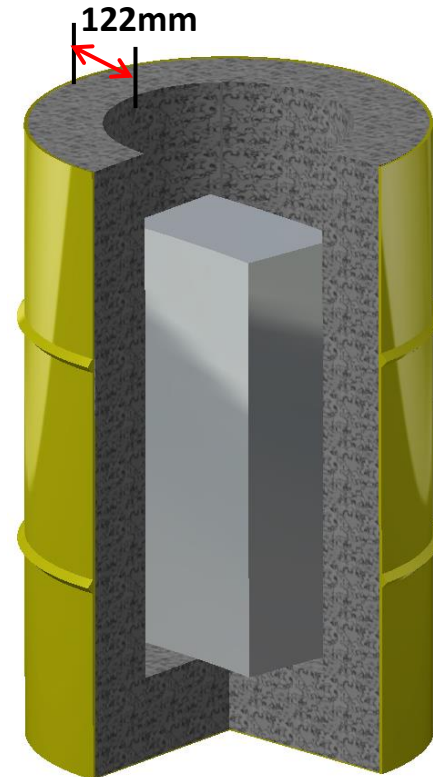


■ 중단부

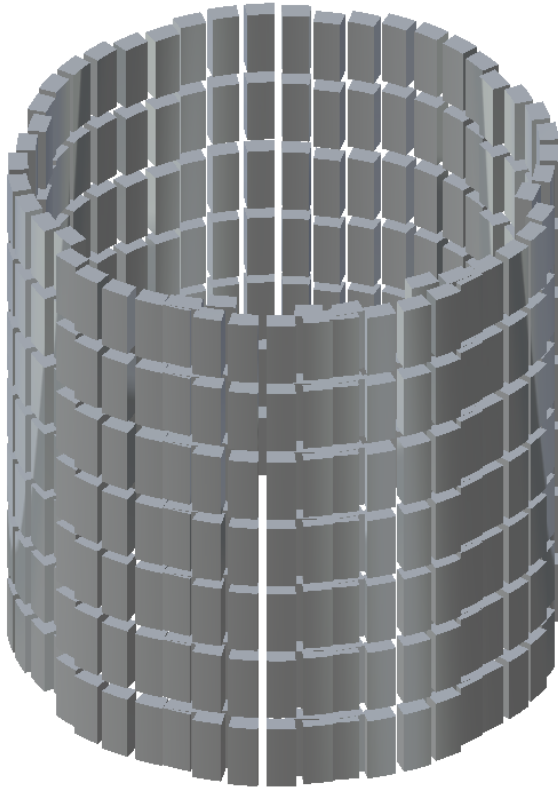
- 중단부는 동일한 크기로 절삭 후 저장함



중단부를 구분한 모습



중단부를 저장한 모습



중단부를 절삭한 모습

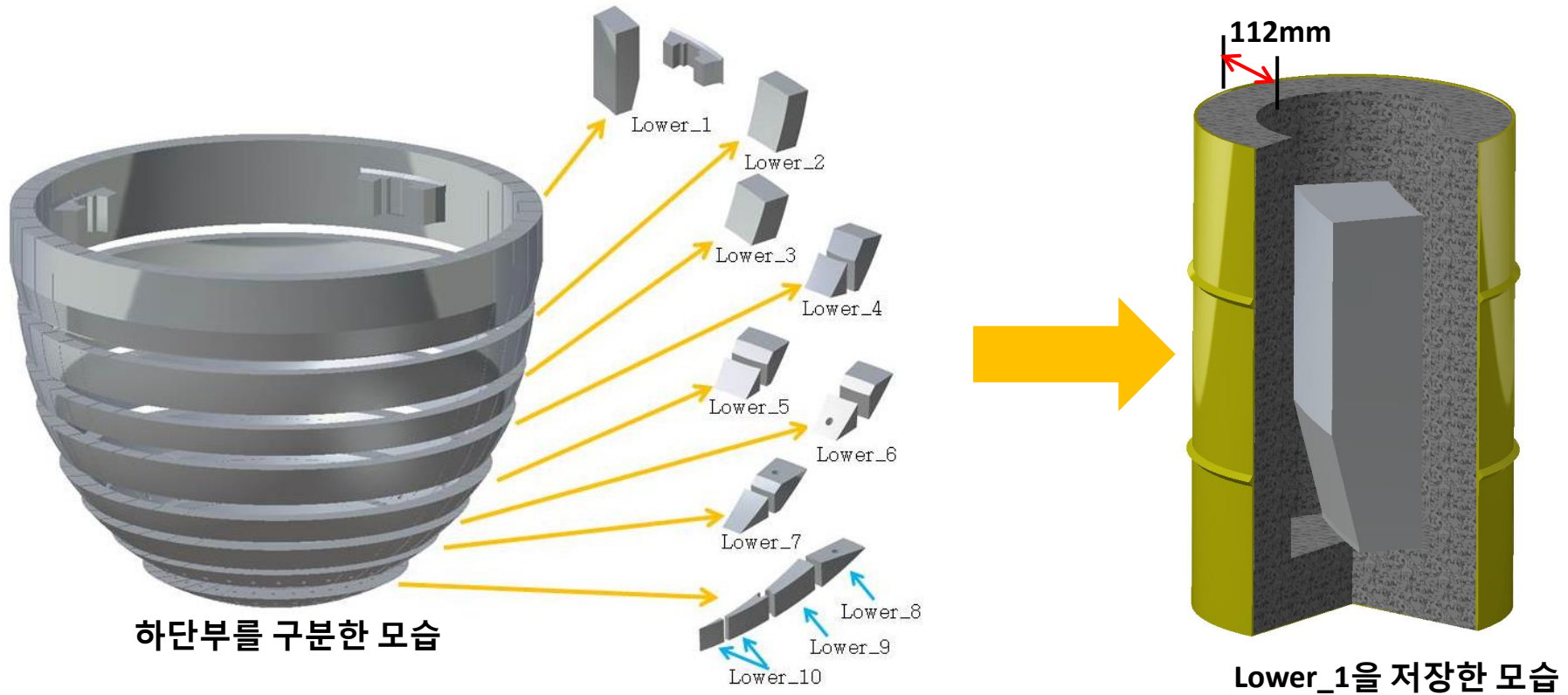
중단부를 절삭한 결과

	Cutting angle (deg)	Cutting height (mm)	Thickness of shield (mm)	Number of cutting	Total of drum (1drum)
Middle	8	600	122	368	300(1)



■ 하단부

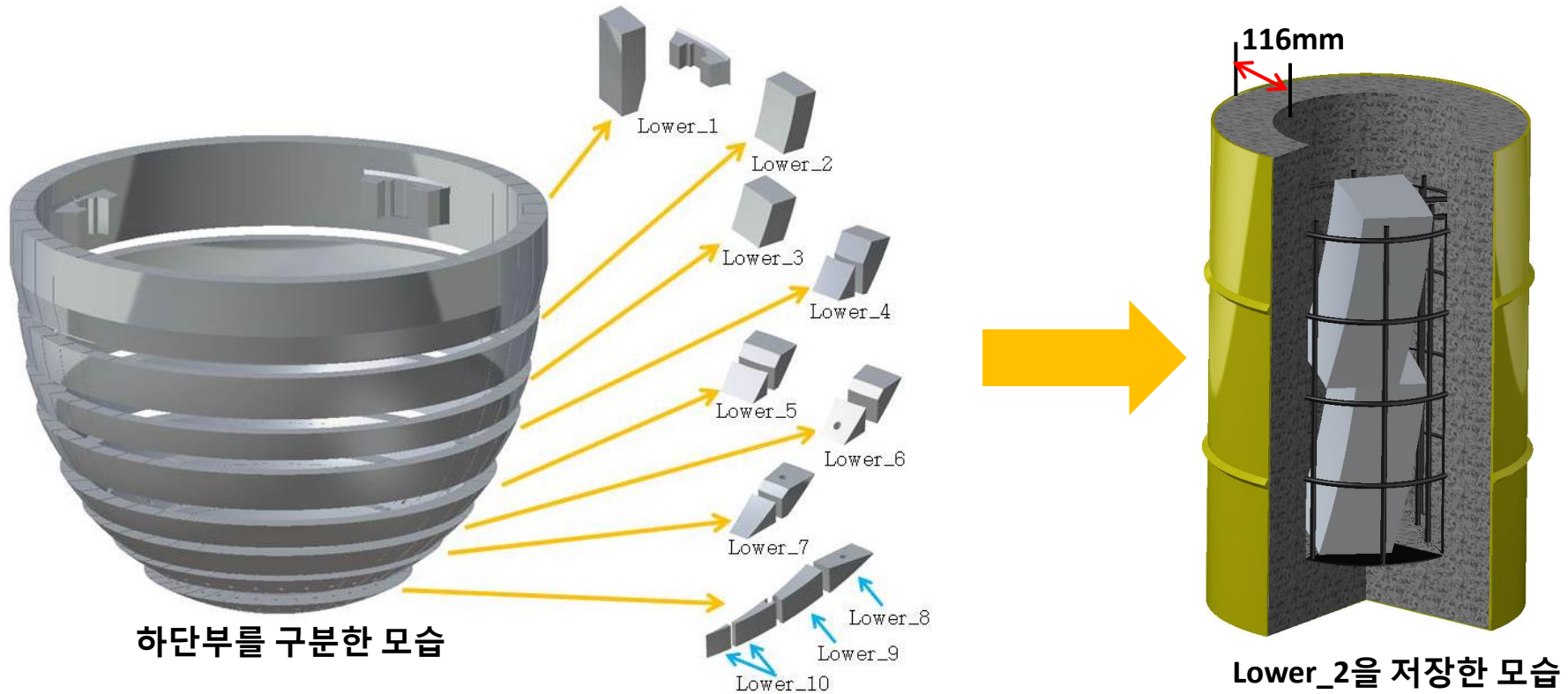
- Geometry에 따라 하단부를 10부분으로 구분하고 절삭을 함





■ 하단부

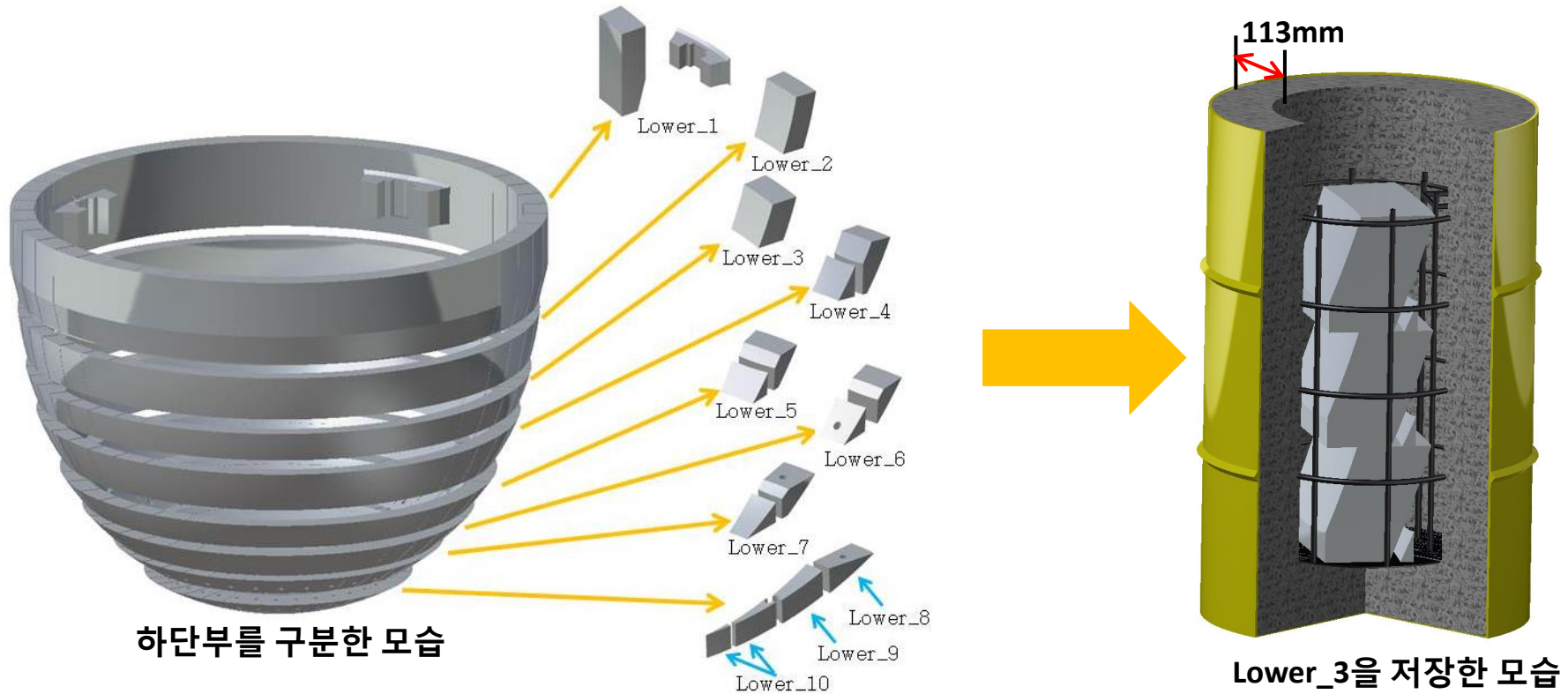
- Geometry에 따라 하단부를 10부분으로 구분하고 절삭을 함





■ 하단부

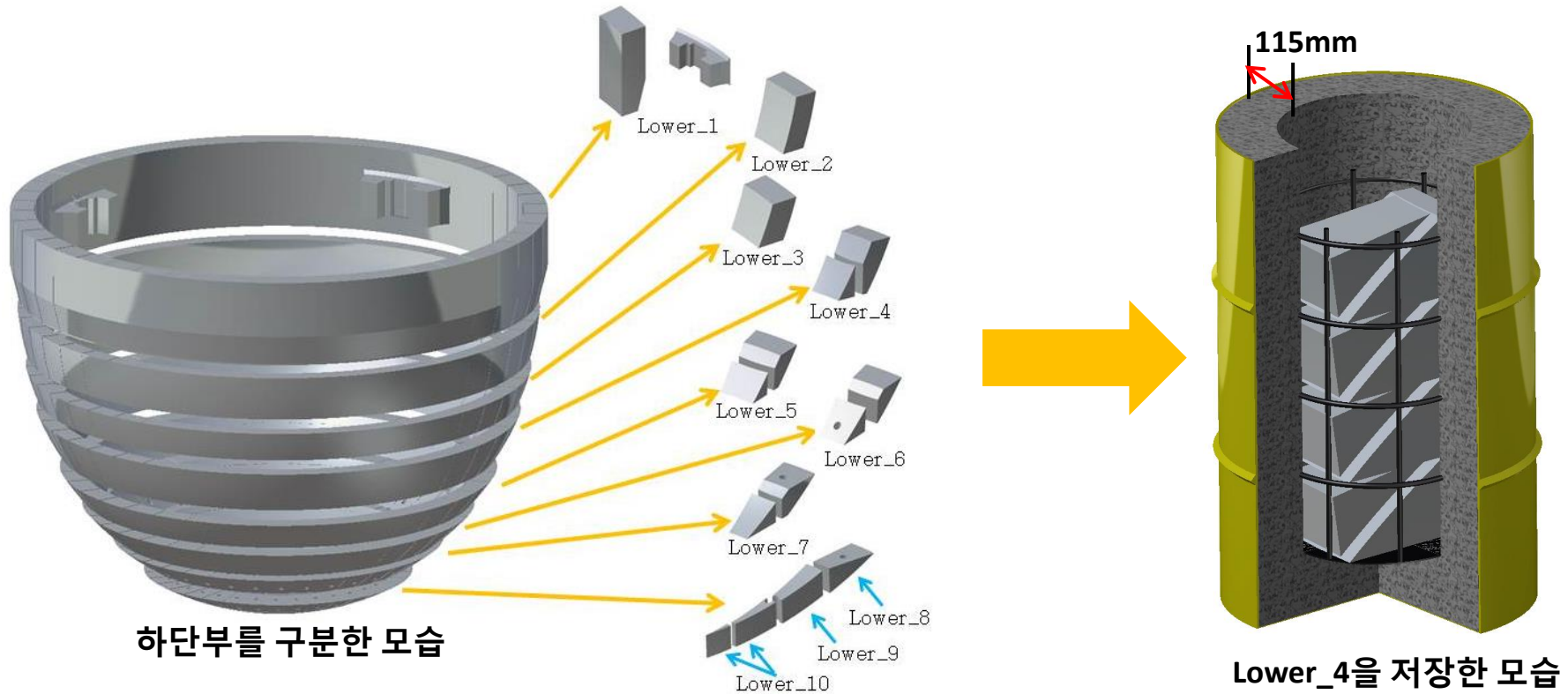
- Geometry에 따라 하단부를 10부분으로 구분하고 절삭을 함





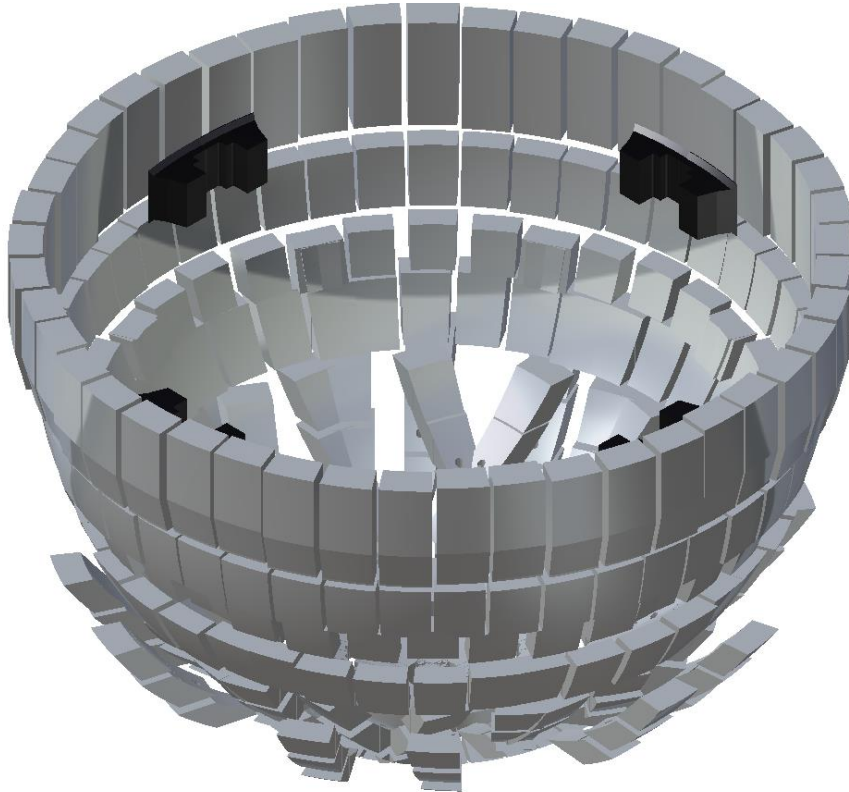
■ 하단부

- Geometry에 따라 하단부를 10부분으로 구분하고 절삭을 함





하단부를 절삭한 결과



하단부를 절삭한 모습

	Cutting angle (deg)	Cutting height (mm)	Thickness of shield (mm)	Number of cutting	Total of drum (1drum)
Lower_1	8	600	112	62	49(1)
Lower_2	8	310	116	46	22(2)
Lower_3	8	210	113	46	15(3)
Lower_4	9	300	115	81	20(2)
Lower_5	10	200	118.5	73	12(3)
Lower_6	10	200	118.5	73	12(3)
Lower_7	8	150	118	73	9(4)
Lower_8	10	132	114	37	4(8)
Lower_9	10	123	120	37	4(8)
Lower_10	10	123	114	73	3(12)
Total				528	147

An hourglass with a wooden frame and a black top and bottom cap. The hourglass is filled with sand, and the top bulb is partially filled with a green liquid. A white rounded rectangular frame is overlaid on the hourglass, containing the number 4 and the word Conclusions.

4

Conclusions

• 2500 ℓ 수납용기와 200 ℓ 드럼 수납 결과 비교

Storage Vessel	2500 ℓ 수납 용기	200 ℓ drum
Cutting angle (deg)	15/ 18	5/6/8/9/10
Cutting height (mm)	2100/1318.04	123/132/150/200/300/595/600
Thickness of shield(mm)	192	114~122
Number of cutting	111	1758
Total of drum	104	929

