INL/EXT-21-64250-Revision-0



# ECAR 4951 BSU-8242 3 DPA As-Run Physics Analysis

July 2020

Jason V Brookman

Changing the World's Energy Future

Idaho National Laboratory

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**Idaho National Laboratory**
**Idaho Falls, Idaho 83415**

**http://www.inl.gov**

**Prepared for the**
**U.S. Department of Energy**
**Under DOE Idaho Operations Office**
**Contract DE-AC07-05ID14517**

| | | | |
|---|---|---|---|
| 1. | Effective Date | 07/02/2020 | **Professional Engineer's Stamp**<br>N/A<br>See LWP-10010 for requirements<br>(*per* LWP-10010 *Sec 4.1, par. cc*) |
| 2. | Does this ECAR involve a Safety SSC? | Yes | |
| 3. | Safety SSC Determination Document ID | NA | |
| 4. | SSC ID | NA | |
| 5. | Project No. | 31418 | |
| 6. | Engineering Job (EJ) No. | NA | |
| 7. | Building | NA | |
| 8. | Site Area | NA | |

9. Objective/Purpose:
The purpose of this report is to document the as-run physics analysis for the Boise State University (BSU-8242) experiment in the A6, A7 and A8 positions, correlating with the 3 DPA specimens irradiated in Cycles 164A, 164B, and 166A. In this paper the heat rate, flux, fluence, and DPA for all specimens are scaled to the appropriate as-run lobe powers for an accurate assessment and description of the irradiated materials. Source terms per capsule are provided, and a bounded source term per specimen type is given on a per gram basis. Verified and validated MCNP full-core models were used for the neutronics analysis.

10. If revision, please state the reason and list sections and/or pages being affected:
Revision 1.

The planned positions for capsule '400C 3 DPA (X)' and capsule '400C 3 DPA (Y)', position A-7 and position A-8, respectively, were swapped during irradiation across all 3 cycles: capsule '400C 3 DPA (X)' was irradiated in the A-8 position, while capsule '400C 3 DPA (Y)' was irradiated in the A-7 position. This irradiation assembly required updating the following tables: Table 10 and Table 11 heating rates; Table 13 and Table 14 neutron flux and fluence; Table 16 and Table 17 displacements per atom; Table 18 decay heat; Table 20 and Table 21 source terms. Additionally, the 'Conclusions/Recommendations' section of the report on page 1 was updated to reflect the changes. Table 1 was also updated. Lastly, Table 22, Table 23, and Table 24 were added to the report to detail the source terms in grams.

See ATTACHMENT B for the original analysis request form, and ATTACHMENT C for the analysis request form in support of a Revision 1. Also provided in 'Attachment C' is the information from Reactor Engineering detailing the irradiation issues that required an updated analysis and revision to the ECAR.

11. Conclusions/Recommendations:
An MCNP full core physics model was used to calculate the as-run heat rates, flux values, fluences, and DPA for each test specimen within the BSU-8242 experiment. The heating rates ranged from 6.67 to 17.37 $\frac{W}{g}$ in position A-6 (300C 3 DPA Capsule), depending on the material and axial location; the heating rates ranged from 5.14 to 16.38 $\frac{W}{g}$ in the A-7 position (400C 3 DPA (Y)), and the heating rates in the A-8 position (400C 3 DPA (X)) ranged from 5.25 to 9.81 $\frac{W}{g}$. The average neutron flux experienced by the BSU-8242 specimens in position A-6 was ~9.08× $10^{14}\frac{n}{cm^2 \cdot s}$, while the average fluence was ~1.47 × $10^{22}\frac{n}{cm^2}$; The average neutron flux in position A-7 was ~8.31× $10^{14}\frac{n}{cm^2 \cdot s}$, while the average fluence was ~1.35 × $10^{22}\frac{n}{cm^2}$; The average neutron flux in position A-8 was ~8.65× $10^{14}\frac{n}{cm^2 \cdot s}$, while the average fluence was ~1.40 × $10^{22}\frac{n}{cm^2}$. The average DPA experienced by the specimens in the A-6 position was calculated to be 4.65, with the average being 4.32 DPA in the A-7 position, and 3.97 DPA in the A-8 position.

The heat rates are reported to support the thermal analysis in assessing the irradiation temperatures each test specimen experienced. The fluence and DPA values are reported to support PIE. In support of PIE, see excel attachment concomitant with this ECAR, which provides the bounding source terms for each specimen material on a per gram basis.

## CONTENTS



## FIGURES



## TABLES

## 1. PROJECT ROLES AND RESPONSIBILITIES

| Project Role | Name (Typed) | Organization | Pages covered (if applicable) |
|---|---|---|---|
| Performer | Jason Brookman | C-130 | All |
| Checker[a] | Brian Gross | C-130 | All |
| Independent Reviewer[b] | N/A | | |
| CUI Reviewer[c] | Brian Gross | C-130 | All |
| Manager[d] | Misti Lillo | C-130 | All |
| Requestor[e] | Katie Anderson | C-601 | All |
| Nuclear Safety[e] | N/A | | |
| Document Owner[e] | Donna Guillen | B-120 | All |

**Responsibilities:**

a. Confirmation of completeness, mathematical accuracy, and correctness of data and appropriateness of assumptions.
b. Concurrence of method or approach. See definition, LWP-10106.
c. Concurrence with the document's markings in accordance with LWP-11202.
d. Concurrence of procedure compliance. Concurrence with method/approach and conclusion.
e. Concurrence with the document's assumptions and input information. See definition of Acceptance, LWP-10200.

**NOTE:** *Delete or mark "N/A" for project roles not engaged. Include ALL personnel and their roles listed above in the eCR system. The list of the roles above is not all-inclusive. If needed, the list can be extended or reduced.*

## 2. SCOPE AND BRIEF DESCRIPTION

This Engineering Calculations Analysis Report (ECAR) documents the as-run results of the Advanced Test Reactor (ATR) physics analysis performed to support the irradiation of the Boise State University-8242 (BSU-8242) experiment in the A6, A7, and A8 positions of the ATR for the 3 DPA specimens. The purpose of this analysis is to calculate the following as-run data:

- Heat generation rate (HGR) of each test specimen
- Flux and fluence for each test specimen
- Displacements per atom (DPA) for each specimen.
- Source terms per capsule are given, and a bounded source term per specimen type is given on a per gram basis.

The as-run heating rates, neutron flux/fluence results, and DPA were calculated using the MCNP ATR full core model. The heating rates and fluence values were based on ATR operating conditions for the cycles of operation. Insertion of the BSU-8242 3 DPA irradiation test began on September 18, 2018 with Cycle 164B, continued through Cycle 166A, and ended irradiation with the ending of Cycle 166B on January 10, 2020.

The BSU-8242 experiment consists of seven capsules loaded with 256 material test specimens, collectively, that were irradiated in the A-6, A-7, and A-8 positions of the ATR. Four capsules with a target of 1 DPA occupied the A-7 and A-8 test positions during ATR Cycle 164A. These capsules were removed after one cycle of irradiation and three different capsules were loaded in the A-6, A-7, and A-8 test positions beginning in ATR Cycle 164B with a minimum target of 3 DPA.

BSU-8242 implemented additional flux wires and other means to measure the actual flux/exposure of the test specimens; thus, the primary function of the Monte Carlo N-Particle (MCNP) tool is to provide best estimates of the specimens irradiated for post irradiation analysis. Ultimately, the objective of BSU-8242 is to provide: 1.) a comparison of the irradiation response of five PM-HIP alloys to that of their conventionally-fabricated counterparts; 2.) an understanding of temperature functionality; and 3.) an understanding of the dose evolution of the irradiation effects.

Manufacturing processes have considerable influence over the safety and integrity of nuclear reactor vessel internal components. These processes are well-established; structural and pressure-retaining materials used in the nuclear power industry have been produced by casting, plate rolling-and-welding, forging, drawing, and extrusion, for the past 60 years. However, issues of weldability and inspectability continue to challenge the manufacture of reactor internals. Furthermore, all of these components will be subject to harsh service environments, which combine high radiation fluence, high temperature, mechanical stress, and often, corrosion potential. These conditions will accelerate material degradation and failure. Advanced fission reactor designs as well as life extensions to the existing fleet of light water reactors will exacerbate material degradation issues by increasing the duty on structural materials. Thus, ensuring the integrity of structural materials in such extreme environments is of utmost importance to the continued safety and operation of nuclear power plants.

The objective of this project is to assess the viability of using alloys manufactured by powder metallurgy and hot isostatic pressing (PM-HIP) as nuclear reactor internals, to enhance the weldability and inspectability of these components. Recently, alloys produced by PM-HIP have been developed and introduced for pressure-retaining applications in the electric power industry. These PM-HIP components exhibit good structural uniformity, no chemical segregation, superior mechanical properties, and

enhanced weldability. PM-HIP components are produced near-net shape, which offers the distinct advantages of minimizing the need for machining and enhancing the ease of inspectability of the component. These superior properties make PM-HIP alloys potential candidates for structural materials in nuclear reactor technologies, including light water reactors (LWRs), advanced light water reactors (ALWRs), small modular reactors (SMRs), and advanced (e.g. Generation IV) reactor designs. However, little is known about the irradiation response of PM-HIP alloys, particularly in comparison to that of conventionally-manufactured alloys. Understanding these irradiation effects is the focus of this project.

## 3. DESIGN PARAMETERS AND EXPERIMENT DESCRIPTION

The Boise State University-8242 experiment was a drop-in design irradiated for 4 cycles in the Advanced Test Reactor (ATR). Idaho National Laboratory (INL), through the Department of Energy Idaho Operations office, irradiated specimens for the Nuclear Science User Facilities (NSUF).

An MCNP snapshot depicting a cross-section of the ATR core is provided in Figure 1. Seven BSU-8242 capsules loaded with 256 materials test specimens, collectively, were irradiated in the A-6, A-7, and A-8 ATR irradiation positions. Four capsules occupied the A-7 and A-8 test positions beginning in ATR Cycle 164A. These capsules were removed after one cycle of irradiation and three different capsules were loaded in the A-6, A-7, and A-8 test positions beginning in ATR Cycle 164B. The BSU-8242 capsules were not irradiated during ATR PALM cycles.

The 256 materials test specimens consisted of 28 Compact Test (CT) specimens, 48 round tensile (RT) specimens, and 180 Transmission Electron Microscope (TEM) specimens. Of the 180 TEM specimens, 36 were composed of Hf-Al alloys inserted in available space within the seven BSU-8242 capsules, intended for the NSUF sample library at HFEF. These 256 test specimens consisted of nine unique material types: six BSU-8242 materials and three Hf-Al alloys.

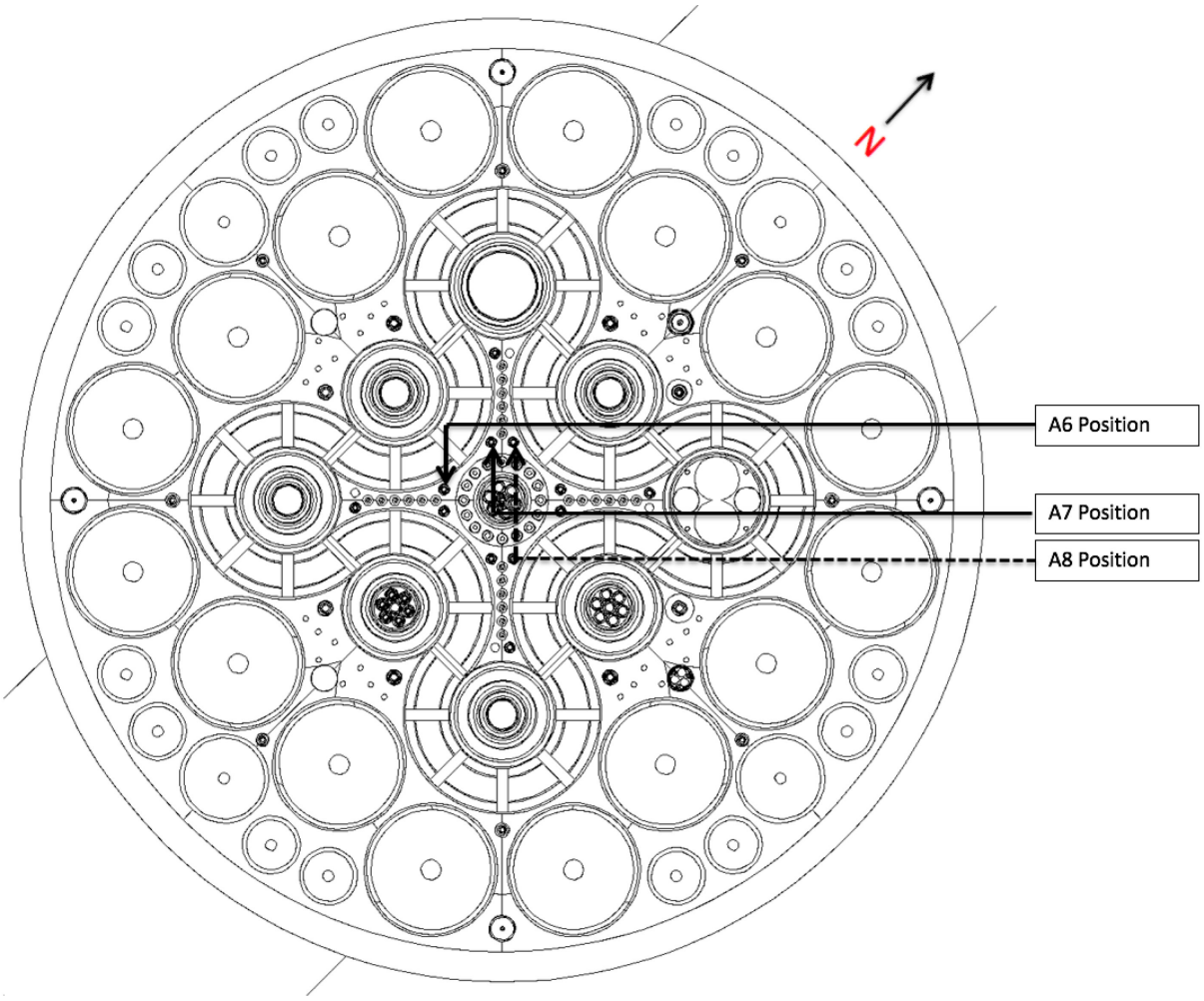


Figure 1. Cross-Section of ATR with the A-6, A-7, and A-8 positions shown.

The BSU-8242 TEM discs were 3mm in diameter and 150 $\pm$ 50$\mu m$ in thickness. The Hf-Al TEM discs were 3mm $\pm$ 50$\mu m$ in diameter and 300 $\pm$ 50$\mu m$ thick. The round tensile specimens had a gauge length of 31.75mm $\pm$ 50$\mu m$ and a total length of 76.2mm $\pm$ 50$\mu m$. The CT specimens measured 10mm $\pm$ 50$\mu m$ x 9.6mm $\pm$ 50$\mu m$ with a thickness of 4mm $\pm$ 50$\mu m$.

An overview of the experiment and capsule descriptions can be found in Table 1. Table 2 provides the chemical composition of the 6 BSU-8242 specimen alloys, and Table 3 provides the chemical composition of the additional Hf-Al TEM specimens. Figure 2 through Figure 5 provide schematic/dimensional representations of the BSU-8242 experiment setup. A more involved designation of all specimens within each capsule is provided in Table 4. Table 5 provides the lobe powers per cycle and EFPDs for Cycles 164B-1, 166A-1, and 166B-1.

Table 1. Overview of the BSU-8242 Experiment.

| Test Train ID# | Capsule ID | Specimen content | Irradiation Cycles | ATR position |
|---|---|---|---|---|
| 8242-A | 300C/1 DPA (X) | RT specimens: 2<br>CT specimens: 4<br>TEM specimens: 21 | 164A | A7 |
| | 400C/1 DPA (X) | RT specimens: 8<br>CT specimens: 4<br>TEM specimens: 48 | 164A | A7 |
| 8242-B | 300C/1 DPA (Y) | RT specimens: 2<br>CT specimens: 4<br>TEM specimens: 0 | 164A | A8 |
| | 400C/1 DPA (Y) | RT specimens: 8<br>CT specimens: 4<br>TEM specimens: 9 | 164A | A8 |
| 8242-C | 300C/3 DPA | RT specimens: 8<br>CT specimens: 4<br>TEM specimens: 33 | 164B, 166A, 166B | A6 |
| 8242-D | 400C/3 DPA (Y) | RT specimens: 10<br>CT specimens: 4<br>TEM specimens: 60 | 164B, 166A, 166B | A7 |
| 8242-E | 400C/3 DPA (X) | RT specimens: 10<br>CT specimens: 4<br>TEM specimens: 9 | 164B, 166A, 166B | A8 |

Table 2. Chemical Composition of BSU-8242 Specimen Alloys (wt/o %) [11].

| **Chemical Composition of BSU-8242 Specimen Alloys** | | | | | | |
|---|---|---|---|---|---|---|
| **Element** | **304L** | **316L** | **625** | **690** | **SA 508** | **Grade 91** |
| $\rho \left(g/cm^3\right)$ | 8.03 | 7.99 | 8.44 | 8.19 | 7.83 | 7.81 |
| C | 0.03 | 0.03 | 0.10 | 0.05 | 0.27 | 0.10 |
| Mn | 2.00 | 2.00 | 0.50 | 0.50 | 0.75 | 0.46 |
| P | 0.045 | 0.045 | 0.015 | - | 0.025 | 0.02 |
| S | 0.03 | 0.03 | 0.015 | 0.015 | 0.025 | 0.01 |
| Si | 0.75 | 0.75 | 0.50 | 0.50 | 0.275 | 0.37 |
| Cr | 19 | 17 | 21.42 | 30 | 0.35 | 8.72 |
| Ni | 10 | 12 | 57.95 | 57.975 | 0.75 | 0.40 |
| Al | 0.10 | - | 0.40 | 0.02 | - | 0.04 |
| Mo | - | 2.50 | 9.00 | - | 0.63 | 0.95 |
| N | 0.10 | 0.10 | - | - | - | 0.053 |
| Nb | - | - | 3.65 | - | - | 0.08 |
| Ti | - | - | 0.40 | - | - | 0.01 |
| Ta | - | - | 0.05 | - | - | - |
| Cu | - | - | - | 0.50 | - | - |
| Co | - | - | 1.00 | - | - | - |
| V | - | - | - | - | 0.05 | 0.215 |
| Zr | - | - | - | - | - | - |
| Fe | 67.945 | 65.545 | 5.00 | 10.44 | 96.875 | 88.572 |

Table 3. Weight Percent of Elemental Content per Hf-Al Specimen type [12].

| **Material Specification** | | | |
|---|---|---|---|
| **Element** | **20% Hf-Al** | **28.4% Hf-Al** | **36.5% Hf-Al** |
| $\rho \left(g/cm^3\right)$ | 3.43 | 3.74 | 3.95 |
| | wt% | wt% | wt% |
| Al | 74.76 | 67.04 | 60.7 |
| Zr | 0.885 | 0.885 | 0.885 |
| Hf | 24.36 | 32.08 | 38.42 |

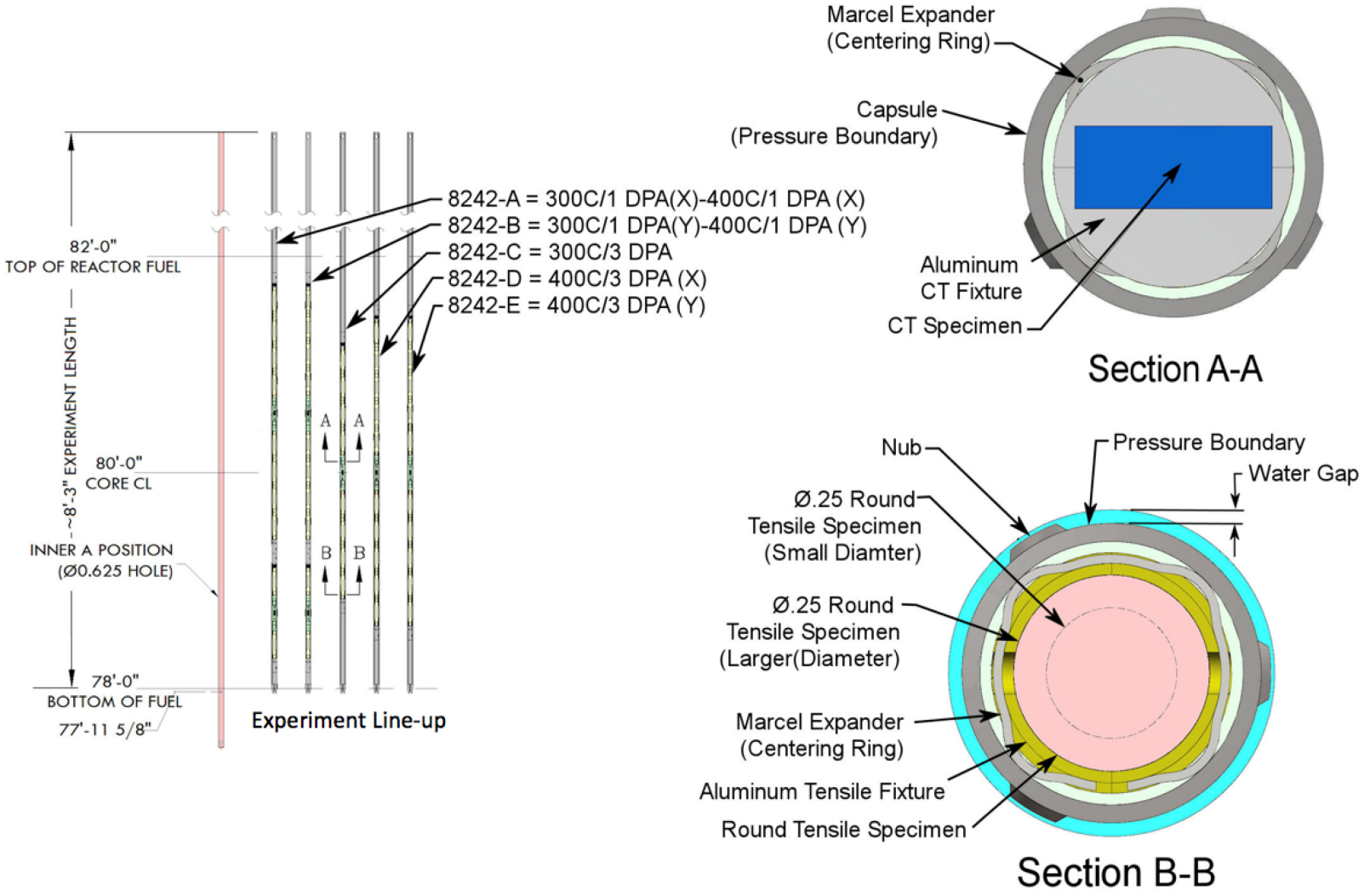


Figure 2. BSU-8242 Capsule Design & Specification (dimensions are given in inches)

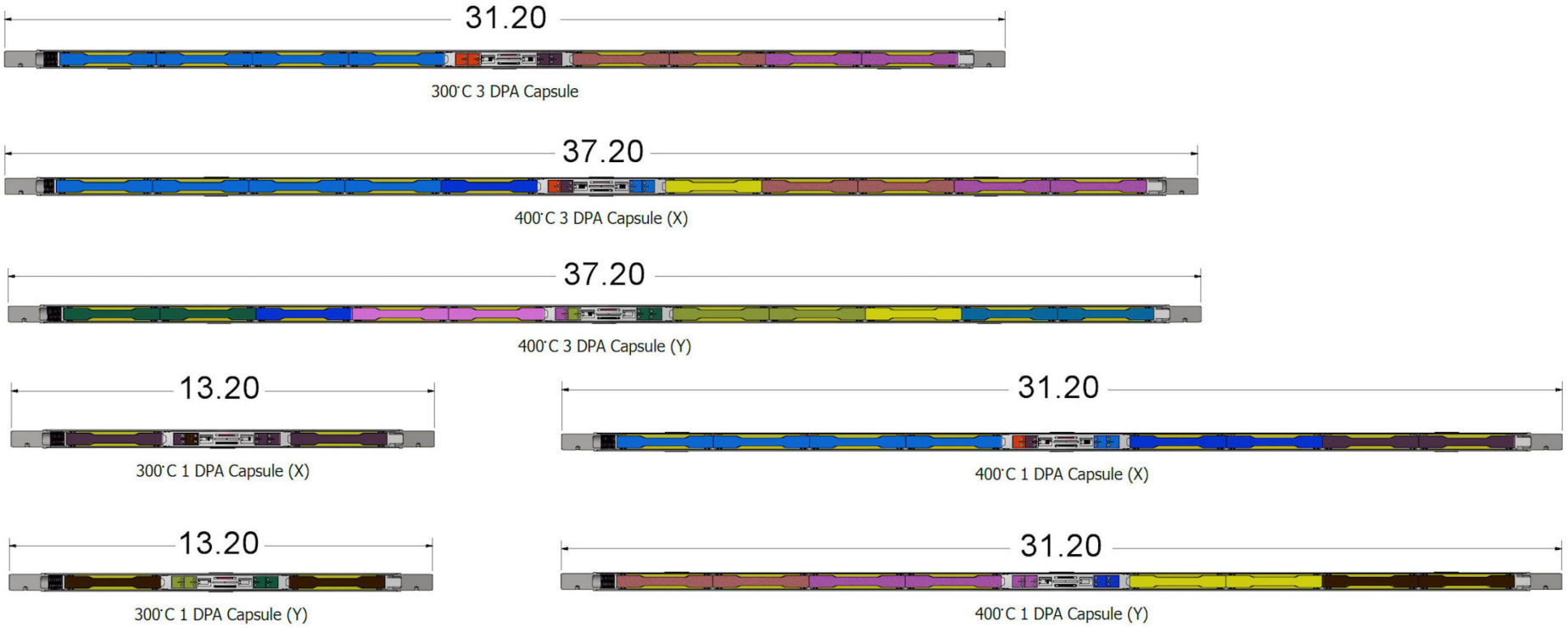


Figure 3. BSU-8242 Capsule Length and Identification (dimensions are given in inches).

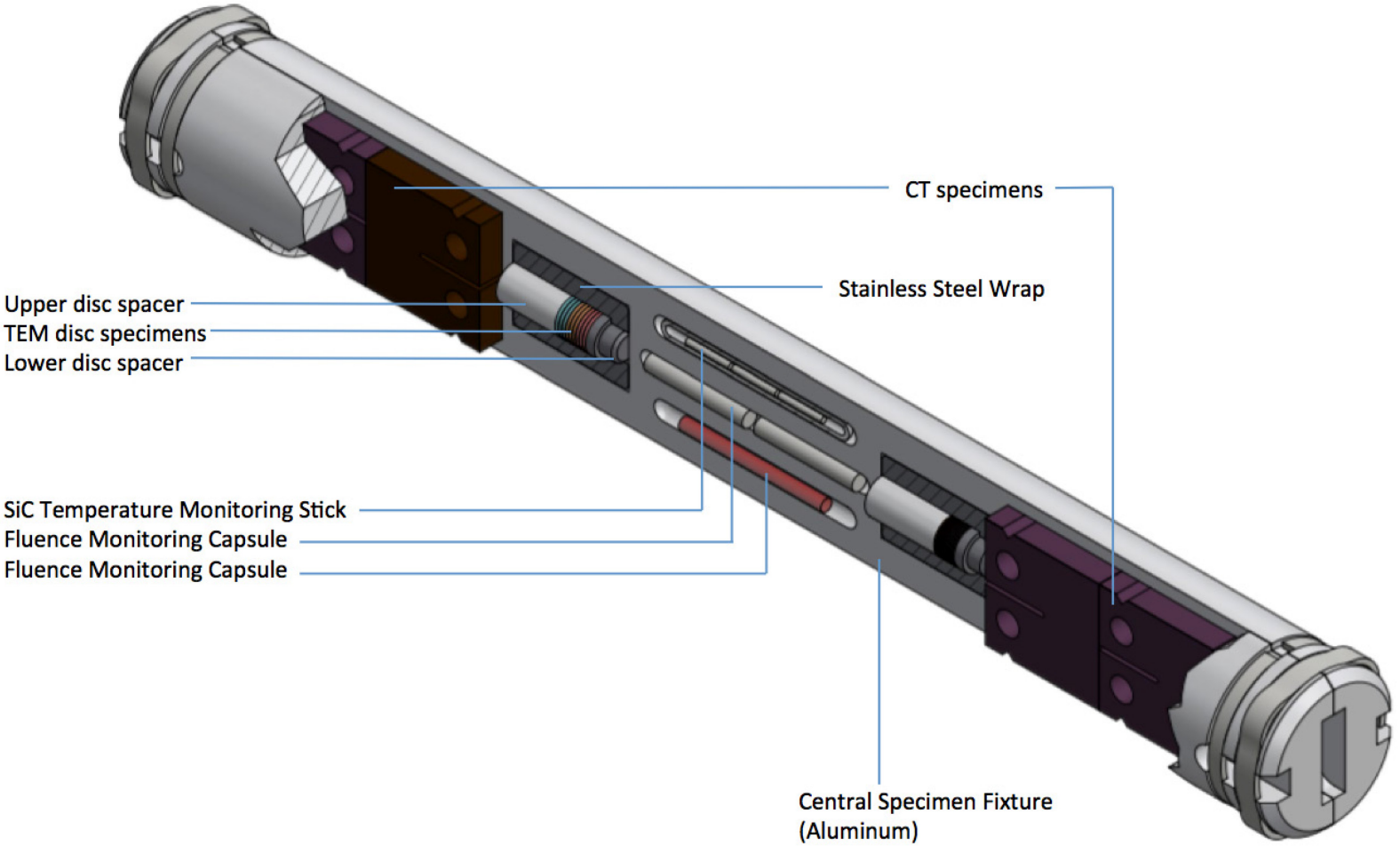


Figure 4. BSU-8242 Central Fixture Overview for all Capsules

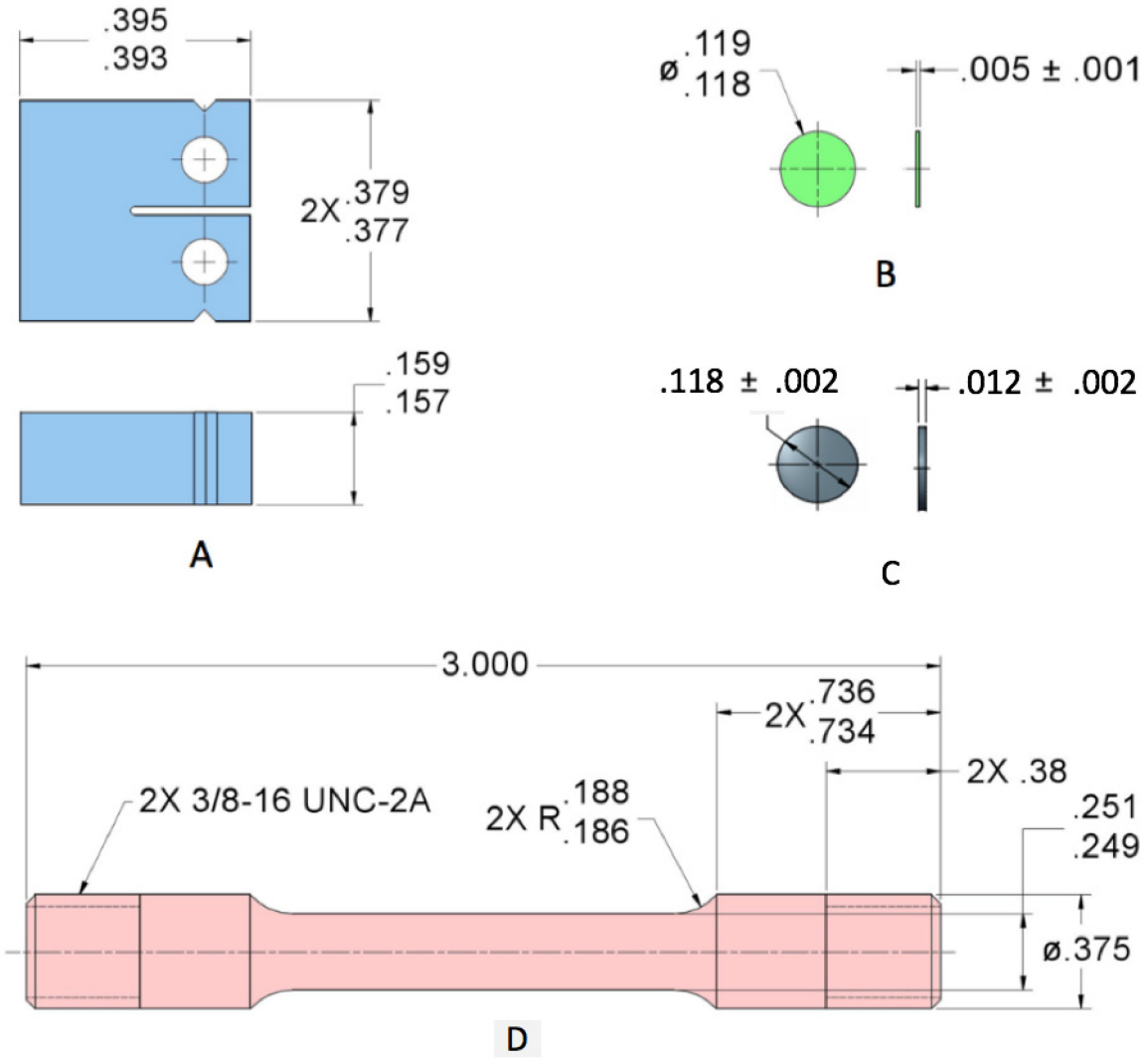


Figure 5. BSU-8242 Specimen Dimensions (dimensions are given in inches): A) Compact Test (CT) Specimen; B) Transmission Electron Microscope Disc (TEM) Specimen; C) USU Hf-Al TEM specimen; D) Round Tensile (RT) Specimen

Table 4. Specimen organization across the 7 capsules composing the BSU-8242 experiment.

| **Specimen Organization** | | | | | | |
|---|---|---|---|---|---|---|
| **400C/ 1DPA (X)** | **300C/ 1DPA (X)** | **400C/ 1DPA (Y)** | **300C/ 1DPA (Y)** | **300C/ 3DPA** | **400C/ 3DPA (X)** | **400C/ 3DPA (Y)** |
| **Top of Capsule** | **Top of Capsule** | **Top of Capsule** | **Top of Capsule** | **Top of Capsule** | **Top of Capsule** | **Top of Capsule** |
| 460. RT-625 | 127. RT-SA508 | 521. RT-625 | 206. RT-508 | 345. RT-690 | 674. RT-690 | 723. RT-304 |
| 459. RT-625 | 126. CT-SA508 | 520. RT-625 | 205. CT-316L | 344. RT-690 | 673. RT-690 | 722. RT-304 |
| 458. RT-690 | 125. CT-SA508 | 519. RT-690 | 204. CT-316L | 343. RT-625 | 672. RT-625 | 721. RT-91 |
| 457. RT-690 | 124. TEM-USU 20 | 518. RT-690 | 203. CT-316L | 342. RT-625 | 671. RT-625 | 720. RT-316 |
| 456. CT-625 | 123. TEM-USU 20 | 517. CT-690 | 202. CT-316L | 341. CT-625 | 670. RT-91 | 719. RT-316 |
| 455. CT-625 | 122. TEM-USU 20 | 516. CT-690 | 201. RT-508 | 340. CT-625 | 669. CT-625 | 718. CT-690 |
| 454. TEM-625 | 121. TEM-USU 28 | 515. TEM-USU 20 | Bottom of Capsule | 339. TEM-USU 20 | 668. CT-625 | 717. CT-316 |
| 453. TEM-625 | 120. TEM-USU 28 | 514. TEM-USU 20 | | 338. TEM-USU 20 | 667. TEM-91 | 716. TEM-USU 36 |
| 452. TEM-625 | 119. TEM-USU 28 | 513. TEM-USU 20 | | 337. TEM-USU 20 | 666. TEM-91 | 715. TEM-USU 36 |
| 451. TEM-625 | 118. TEM-USU 36 | 512. TEM-USU 28 | | 336. TEM-USU 28 | 665. TEM-91 | 714. TEM-USU 36 |
| 450. TEM-625 | 117. TEM-USU 36 | 511. TEM-USU 28 | | 335. TEM-USU 28 | 664. TEM-91 | 713. TEM-USU 28 |
| 449. TEM-625 | 116. TEM-USU 36 | 510. TEM-USU 28 | | 334. TEM-USU 28 | 663. TEM-91 | 712. TEM-USU 28 |
| 448. TEM-625 | 115. TEM-SA508 | 509. TEM-USU 36 | | 333. TEM-USU 36 | 662. TEM-91 | 711. TEM-USU 28 |
| 447. TEM-625 | 114. TEM-SA508 | 508. TEM-USU 36 | | 332. TEM-USU 36 | 661. TEM-304L | 710. TEM-USU 20 |
| 446. TEM-625 | 113. TEM-SA508 | 507. TEM-USU 36 | | 331. TEM-USU 36 | 660. TEM-304L | 709. TEM-USU 20 |
| 445. TEM-625 | 112. TEM-SA508 | 506. CT-91 | | 330. TEM-690 | 659. TEM-304L | 708. TEM-USU 20 |
| 444. TEM-625 | 111. TEM-SA508 | 505. CT-91 | | 329. TEM-690 | 658. TEM-304L | 707. CT-316 |
| 443. TEM-625 | 110. TEM-SA508 | 504. RT-91 | | 328. TEM-690 | 657. TEM-304L | 706. CT-316 |
| 442. TEM-SA508 | 109. TEM-SA508 | 503. RT-91 | | 327. TEM-690 | 656. TEM-304L | 705. RT-316 |
| 441. TEM-SA508 | 108. TEM-SA508 | 502. RT-508 | | 326. TEM-690 | 655. TEM-304L | 704. RT-316 |
| 440. TEM-SA508 | 107. TEM-SA508 | 501. RT-508 | | 325. TEM-690 | 654. TEM-304L | 703. RT-91 |
| 439. TEM-SA508 | 106. TEM-SA508 | Bottom of Capsule | | 324. TEM-625 | 653. TEM-304L | 702. RT-304 |
| 438. TEM-SA508 | 105. TEM-SA508 | | | 323. TEM-625 | 652. TEM-304L | 701. RT-304 |
| 437. TEM-SA508 | 104. TEM-SA508 | | | 322. TEM-625 | 651. TEM-304L | Bottom of Capsule |

Table 4. Specimen organization across the 7 capsules composing the BSU-8242 experiment.

| **Specimen Organization** | | | | | | |
|---|---|---|---|---|---|---|
| **400C/ 1DPA (X)** | **300C/ 1DPA (X)** | **400C/ 1DPA (Y)** | **300C/ 1DPA (Y)** | **300C/ 3DPA** | **400C/ 3DPA (X)** | **400C/ 3DPA (Y)** |
| **Top of Capsule** | **Top of Capsule** | **Top of Capsule** | **Top of Capsule** | **Top of Capsule** | **Top of Capsule** | **Top of Capsule** |
| 436. TEM-SA508 | 103. CT-SA508 | | | 321. TEM-625 | 650. TEM-304L | |
| 435. TEM-SA508 | 102. CT-SA508 | | | 320. TEM-625 | 649. TEM-316L | |
| 434. TEM-SA508 | 101. RT-SA508 | | | 319. TEM-625 | 648. TEM-316L | |
| 433. TEM-SA508 | Bottom of Capsule | | | 318. TEM-690 | 647. TEM-316L | |
| 432. TEM-SA508 | | | | 317. TEM-690 | 646. TEM-316L | |
| 431. TEM-SA508 | | | | 316. TEM-690 | 645. TEM-316L | |
| 430. TEM-91 | | | | 315. TEM-690 | 644. TEM-316L | |
| 429. TEM-91 | | | | 314. TEM-690 | 643. TEM-316L | |
| 428. TEM-91 | | | | 313. TEM-690 | 642. TEM-316L | |
| 427. TEM-91 | | | | 312. TEM-625 | 641. TEM-316L | |
| 426. TEM-91 | | | | 311. TEM-625 | 640. TEM-316L | |
| 425. TEM-91 | | | | 310. TEM-625 | 639. TEM-316L | |
| 424. TEM-91 | | | | 309. TEM-625 | 638. TEM-316L | |
| 423. TEM-91 | | | | 308. TEM-625 | 637. TEM-91 | |
| 422. TEM-91 | | | | 307. TEM-625 | 636. TEM-91 | |
| 421. TEM-91 | | | | 306. CT-625 | 635. TEM-91 | |
| 420. TEM-91 | | | | 305. CT-625 | 634. TEM-91 | |
| 419. TEM-91 | | | | 304. RT-625 | 633. TEM-91 | |
| 418. TEM-690 | | | | 303. RT-625 | 632. TEM-91 | |
| 417. TEM-690 | | | | 302. RT-690 | 631. TEM-690 | |
| 416. TEM-690 | | | | 301. RT-690 | 630. TEM-690 | |
| 415. TEM-690 | | | | Bottom of Capsule | 629. TEM-690 | |
| 414. TEM-690 | | | | | 628. TEM-690 | |
| 413. TEM-690 | | | | | 627. TEM-690 | |
| 412. TEM-690 | | | | | 626. TEM-690 | |

Table 4. Specimen organization across the 7 capsules composing the BSU-8242 experiment.

| Specimen Organization | | | | | | |
|---|---|---|---|---|---|---|
| **400C/ 1DPA (X)** | **300C/ 1DPA (X)** | **400C/ 1DPA (Y)** | **300C/ 1DPA (Y)** | **300C/ 3DPA** | **400C/ 3DPA (X)** | **400C/ 3DPA (Y)** |
| **Top of Capsule** | **Top of Capsule** | **Top of Capsule** | **Top of Capsule** | **Top of Capsule** | **Top of Capsule** | **Top of Capsule** |
| 411. TEM-690 | | | | | 625. TEM-690 | |
| 410. TEM-690 | | | | | 624. TEM-690 | |
| 409. TEM-690 | | | | | 623. TEM-690 | |
| 408. TEM-690 | | | | | 622. TEM-690 | |
| 407. TEM-690 | | | | | 621. TEM-690 | |
| 406. CT-690 | | | | | 620. TEM-690 | |
| 405. CT-690 | | | | | 619. TEM-625 | |
| 404. RT-91 | | | | | 618. TEM-625 | |
| 403. RT-91 | | | | | 617. TEM-625 | |
| 402. RT-SA508 | | | | | 616. TEM-625 | |
| 401. RT-SA508 | | | | | 615. TEM-625 | |
| Bottom of Capsule | | | | | 614. TEM-625 | |
| | | | | | 613. TEM-625 | |
| | | | | | 612. TEM-625 | |
| | | | | | 611. TEM-625 | |
| | | | | | 610. TEM-625 | |
| | | | | | 609. TEM-625 | |
| | | | | | 608. TEM-625 | |
| | | | | | 607. CT-690 | |
| | | | | | 606. CT-690 | |
| | | | | | 605. RT-91 | |
| | | | | | 604. RT-625 | |
| | | | | | 603. RT-625 | |
| | | | | | 602. RT-690 | |
| | | | | | 601. RT-690 | |

Table 4. Specimen organization across the 7 capsules composing the BSU-8242 experiment.

| Specimen Organization | | | | | | |
|---|---|---|---|---|---|---|
| **400C/ 1DPA (X)** | **300C/ 1DPA (X)** | **400C/ 1DPA (Y)** | **300C/ 1DPA (Y)** | **300C/ 3DPA** | **400C/ 3DPA (X)** | **400C/ 3DPA (Y)** |
| **Top of Capsule** | **Top of Capsule** | **Top of Capsule** | **Top of Capsule** | **Top of Capsule** | **Top of Capsule** | **Top of Capsule** |
| | | | | | Bottom of Capsule | |

Table 5. BSU-8242 cycle irradiation overview [1].

| Parameter | Cycle[1,2] | | | |
|---|---|---|---|---|
| | 1 DPA | 3 DPA | | |
| | 164A-1 | 164B-1 | 166A-1 | 166B-1 |
| NW (MW) | 20.0 | 19.5 | 19.9 | 19.9 |
| NE (MW) | 16.0 | 16.4 | 16.9 | 16.9 |
| C (MW) [1] | 19.4 | 19.7 | 21.9 | 22.1 |
| SW (MW) | 22.4 | 23.1 | 25.8 | 25.9 |
| SE (MW) | 25.7 | 25.1 | 25.6 | 25.0 |
| Total Core (MW) | 103.5 | 103.8 | 110.1 | 109.8 |
| EFPDs | 54.9 | 64.1 | 62.5 | 61.2 |
| Post Outage (days) | 32 | 189 | 34 | -- |

1 BSU-8242 data was scaled to the center lobe powers.

2 ATR lobe powers per cycle are given in reference [1].

## 4. RESULTS OF LITERATURE SEARCHES AND OTHER BACKGROUND DATA

MCNP5 release 1.60 [2][3], a general purpose Monte Carlo N-Particle (MCNP) transport code, was used to model and evaluate the neutron and photon heating of the BSU-8242 components, the neutron flux and fluence values, and the DPA of each test specimen.

### 4.1 MCNP Model

The MCNP models describing the BSU-8242 experiment in three of the ATR inner-A positions are based on the drawings listed in Table 6. The BSU-8242 test was axially centered (by position) about the ATR core mid-plane within each MCNP model.

Table 6. Drawing Number for BSU-8242.

| Drawing Number | Revision | Drawing Title |
|---|---|---|
| 605765 | 3 | ATR NSUF BOISE EXPERIMENT 8242 INBOARD A CAPSULE COMPONENT ASSEMBLIES AND DETAILS |
| 605766 | 0 | ATR NSUF BOISE EXPERIMENT 8242 300C-1 DPA X INBOARD A CAPSULE CT AND TEM SPECIMEN ASSEMBLY |
| 605767 | 2 | ATR NSUF BOISE EXPERIMENT 8242 300C-1 DPA Y INBOARD A CAPSULE CT AND TEM SPECIMEN ASSEMBLY |
| 605768 | 1 | ATR NSUF BOISE EXPERIMENT 8242 300C-3 DPA INBOARD A CAPSULE CT AND TEM SPECIMEN ASSEMBLY |
| 605770 | 0 | ATR NSUF BOISE EXPERIMENT 8242 400C-1 DPA Y INBOARD A CAPSULE CT AND TEM SPECIMEN ASSEMBLY |
| 605771 | 2 | ATR NSUF BOISE EXPERIMENT 8242 400C-1 DPA X INBOARD A CAPSULE CT AND TEM SPECIMEN ASSEMBLY |
| 605772 | 1 | ATR NSUF BOISE EXPERIMENT 8242 400C-3 DPA Y INBOARD A CAPSULE CT AND TEM SPECIMEN ASSEMBLY |
| 605773 | 3 | ATR NSUF BOISE EXPERIMENT 8242 INBOARD A CAPSULE DRAWING TREE |
| 605774 | 3 | ATR NSUF BOISE EXPERIMENT 8242 SPECIMEN ASSEMBLY AND DETAILS |
| 605775 | 0 | ATR NSUF BOISE EXPERIMENT 8242 INBOARD A CAPSULE TENSILE SPECIMEN ASSEMBLIES |
| 605776 | 1 | ATR NSUF BOISE EXPERIMENT 8242 300C-1 DPA X INBOARD A CAPSULE ASSEMBLY |
| 605777 | 1 | ATR NSUF BOISE EXPERIMENT 8242 300C-3 DPA INBOARD A CAPSULE ASSEMBLY |
| 605778 | 1 | ATR NSUF BOISE EXPERIMENT 8242 300C-1 DPA Y INBOARD A CAPSULE ASSEMBLY |
| 605824-1 | 2 | ATR BSU-8242 EXPERIMENT INBOARD A CAPSULE 300C/1 DPA (X) AND 400C/1 DPA (X) TEST TRAIN ASSEMBLY |
| 605825-1 | 2 | ATR BSU-8242 EXPERIMENT INBOARD A CAPSULE 300C/1 DPA (Y) AND 400C/1 DPA (Y) TEST TRAIN ASSEMBLY |
| 605826-1 | 3 | ATR BSU-8242 EXPERIMENT INBOARD A CAPSULE 300C/3 DPA TEST TRAIN ASSEMBLY |

Table 6. Drawing Number for BSU-8242.

| **Drawing Number** | **Revision** | **Drawing Title** |
|---|---|---|
| 605827-1 | 3 | ATR BSU-8242 EXPERIMENT INBOARD A CAPSULE 400C/3 DPA (X) TEST TRAIN ASSEMBLY |
| 605828-1 | 2 | ATR BSU-8242 EXPERIMENT INBOARD A CAPSULE 400C/3 DPA (Y) TEST TRAIN ASSEMBLY |
| 605829 | 1 | ATR NSUF BOISE EXPERIMENT 8242 INBOARD A CAPSULE TEST TRAIN INSTALLATION |
| 120421 | 11 | ATR OUTBOARD AND INBOARD “A” POSITION SPECIMEN FILLER PLUGS |
| 602380 | 1 | UTAH STATE UNIVERSITY SPECIMEN DETAILS |

## 5. ANALYTICAL METHODOLOGY

MCNP is used to calculate the neutron flux values, heat generation rates and DPA in the BSU-8242 experiment. MCNP reports the flux tallies in units of $1/cm^2$ per source neutron. The following normalization factors are used to calculate the neutron flux and the heat generation rates, as well as the DPA, from the MCNP tallies.

Neutron Flux Normalization Factor

MCNP reports tally results normalized per source particle. The MCNP type 4 flux tally results are used to generate neutron flux input values for BSU-8242. The MCNP tally type 4 (for neutrons) has units of neutrons/$cm^2$ per source neutron. The neutron flux conversion factor (NFCF) is defined by equation (1).

$$NFCF = \left(\frac{2.43\ fission\ neutrons}{fission}\right)\left(\frac{fission}{200\ MeV}\right)\left(\frac{6.24151\times10^{18}\ MeV}{MW_{Core\ Power}\cdot s}\right)$$

$$NFCF = 7.583 \times 10^{16}\,\frac{fission\ neutrons}{MW_{Core\ Power}\cdot s} \tag{1}$$

The neutron flux values are calculated using the MCNP tally type 4 results, the NFCF, and the ATR core power. The neutron flux is calculated using Equation (2).

$$\phi_{neutron} = \left(type\ 4\ tally\,\frac{neutrons}{cm^2 - fission\ neutron}\right)\left(7.583 \times 10^{16}\,\frac{fission\ neutrons}{MW_{core\ power} - s}\right)(Core\ Power\ MW)$$

$$\phi_{neutron} = (f4)(7.583 \times 10^{16})(Core\ Power)\,\frac{neutrons}{cm^2 - s} \tag{2}$$

Neutron/Prompt Gamma Heating Normalization Factor (NHNF)

MCNP reports tally results normalized per source particle. The MCNP type 6 energy deposition tally results or type 7 fission energy deposition tally results are used to calculate heat generation rates. The MCNP tally type 6 has units of MeV/g per source particle (fission neutron for prompt neutron, gamma heating, and fission heating). The heating normalization factor (HNF) is defined by equation (3).

$$HNF = \left(\frac{2.43\ fission\ neutrons}{fission}\right)\left(\frac{fission}{200\ MeV}\right)\left(\frac{1\times10^{6}\ W}{1\ MW}\right)$$

$$HNF = 1.215 \times 10^{4}\,\frac{fission\ neutrons\cdot W}{MW\cdot MeV} \tag{3}$$

The heat generation rate values are calculated using the MCNP tally type 6 results, the HNF, and the ATR core power. Prompt neutron and gamma heating rates (PHR) are calculated using equation (4).

$$PHR = \left(type\ 6\ tally\,\frac{MeV}{g\cdot fission\ neutron}\right)\left(1.215 \times 10^{4}\,\frac{fission\ neutrons\cdot W}{MW\cdot MeV}\right)(Core\ Power\ MW)$$

$$PHR = (f6)(HNF)(Core\ Power)\frac{W}{g} \quad (4)$$

Delayed Fission Product Gamma Heating Normalization Factor

MCNP reports tally results normalized per source particle. The heating tallies have units of MeV/g per fission neutron. The MCNP type 6 energy deposition tally results are used to calculate delayed gamma heat generation rates. The MCNP tally type 6 has units of MeV/g per source particle (per delayed fission product gamma for delayed fission product gamma heating). The delayed photon heating normalization factor (DPHNF) is defined by equation (5) using 8.9603 delayed fission photons per fission [4][5].

$$\mathrm{DPHNF} = \left(\frac{8.9603\ delayed\ photons}{fission}\right)\left(\frac{fission}{200\ MeV}\right)\left(\frac{1\times10^{6}\ W}{MW}\right)$$

$$\mathrm{DPHNF} = 4.480 \times 10^{4}\ \frac{delayed\ photons \cdot W}{MW_{core\ power} \cdot MeV} \quad (5)$$

The heat generation rate values are calculated using the MCNP tally type 6 or type 7 results, the HNF, and the ATR core power. Delayed fission product heating rate (DHR) is calculated using equation (6).

$$DHR = \left(type\ 6\ tally\ \frac{MeV}{g \cdot source\ photon}\right)\left(4.480 \times 10^{4}\ \frac{delayed\ photons \cdot W}{MW \cdot MeV}\right)(Core\ Power\ MW)$$

$$DHR = (f6)(\mathrm{DPHNF})(Core\ Power)\frac{W}{g} \quad (6)$$

Displacements per Atom

To evaluate radiation damage, a fundamental parameter that characterizes lattice displacement events is required. DPA has been used to compare radiation damage by different radiation sources. It is a damage-based exposure unit and represents the number of atoms displaced from their normal lattice sites as a result of energetic particle bombardment. Displacements per atom (DPA) is used to quantify radiation damage (the number of times that an atom is displaced for a given fluence). DPA is a standard measure for computing neutron- and gamma-induced radiation damage of materials that are found in radiation prone environments. It essentially provides the correlation between mechanical structural damage properties associated with the level of radiation that the material has encountered over the time span inside the neutron radiation environment [6].

The DPA rate in a material is estimated by using a tally multiplier card with a standard flux tally in MCNP5: the neutron flux is calculated as a function of energy on a material and it is combined with the DPA cross-section. The tally multiplier card applied to a flux tally calculates the reaction rate that is defined as the quantity:

$$C \int \phi(\mathrm{E})\mathrm{R_m}(\mathrm{E})\mathrm{dE} \quad (7)$$

Where,

$C = multiplicative\ constant$

$\phi(E) = energy\ dependent\ flux$

$R_m(E) = energy\ dependent\ reaction\ rate\ of\ interest$ (ENDF/B-VII damage cross-section)

The quantity:

$$\int \phi(E)R_m(E)dE \tag{8}$$

is the total damage energy rate for the material. Assigning the quantity $\eta/2E_d$ to the constant C in Equation 6 results in:

$$DPA\ rate = \frac{\eta}{2E_d}\int \phi(E)R_m(E)dE \tag{9}$$

$$\phi(E)\ R_m(E) = \text{total damage energy} \tag{10}$$

The DPA cross-section would be calculated by:

$$\sigma_{DPA} = \frac{\int \phi(E)R(E)dE}{\int \phi(E)dE} \tag{11}$$

The resulting cross section has units of MeV-barns per atom.

This is done by employing the cross-section processing code system NJOY [7] to produce microscopic DPA cross-section data. This is due to the fact that NJOY data is based on detailed physical nuclear interactions. It is from this nuclear data that it is possible to generate DPA cross sections, which are accurate for 0 to 20 MeV, making it applicable for LWRs. The NJOY nuclear data processing code is regarded as the golden standard to process evaluated nuclear data files [8]. The damage cross section is produced in the HEATR function within NJOY99, which is used to add heat-production (kerma) and DPA cross sections [9]. To load the DPA cross section into the simulation the MT=444 reaction must be called with the input file [6].

DPA is calculated by folding MCNP5-provided displacement cross sections with the energy dependent neutron particle spectrum. Where the MT=444 card is employed (reaction number for the damage cross sections), the cross sections are folded into the flux tally data, producing tally data that are in units of $\frac{MeV-barns}{cm^2-source\ particles}$. The following method is then used to calculate the DPA:

$$DPA\ rate\ \left(\frac{dpa}{s}\right) = \left[FMn(E)\cdot\sigma(E)_{damage\ cross-section}\right]_{tally}\cdot\ \eta\ \cdot\ \frac{1}{2E_d}\ \cdot$$
$$Neutron\ Flux\ Normalization\ Factor\ \cdot\ Core\ Power\cdot\ Unit\ Conversion\ Factor \quad (12)$$

where the tally is in units of $\frac{MeV-barns}{cm^2-source\ particles}$; $\eta$ is the efficiency, usually taken to be 0.8; $E_d$ is the weighted average cutoff energy of the specimen material, calculated by an atomic weighted average of the material (the typical stainless steel value employed is $40 \times 10^{-6}$ MeV, which is the value used for this analysis for both the rodlet and capsule); the NFCF is defined above $\left(7.583 \times 10^{16}\frac{fission\ neutrons}{MW_{Core\ Power}\cdot s}\right)$; the unit conversion factor is $1 \times 10^{-24}\ \frac{cm^2}{b}$. The DPA rate is then multiplied by the irradiation time to give the displacements per atom.

## 6. ASSUMPTIONS

The following assumptions are used in this analysis:

1. The core operates with the lobe powers specified in Table 5 for cycles 164B-1, 166A-1, and 166B-1. The lobe powers were taken from Reference [1] (also see ATTACHMENT A for a listing of the average ATR lobe power values per cycle). Heat rates, fluxes, and DPA results are scaled to the center lobe power. Changes in the center lobe power should be accounted for in the HGR and DPA results by multiplying by the ratio of the new center lobe power over the analyzed center lobe power.
2. Heating rate values reported for all capsules include energy deposition from prompt neutrons, prompt gammas, and delayed fission product gammas.
3. The ATR fuel model consists of three radial and seven axial zones to represent the ATR fuel elements.
4. An atomic displacement energy of 40 eV (for calculating DPA) was applied to every material analyzed in this ECAR, aside from the USU samples. This value is appropriate for stainless steels and is applicable to the BSU-8242 specimens. The DPA for the USU specimens (of differing hafnium amounts) were calculated using the following cutoff energies: 32.7 eV, 34.5 eV, and 36.0 eV for the 20%, 28.4%, and 36.5% Hf-Al samples, respectively. The cutoff energy for each of the USU specimens was calculated by an elemental weighted average approach.
5. This analysis used the same density for each of the three types of material fabrication methods (PM-HIP, cast, and forged).
6. The Hf-Al samples are composed of hafnium-aluminum alloy “microspheres” (3 aluminum to 1 hafnium by atom percent) dispersed within an aluminum matrix at three differing volume percentages (20%, 28.4%, and 36.5%).

## 7. COMPUTER CODE VALIDATION

Release 1.60 of MCNP (References [2] [3]), a general purpose Monte Carlo N-Particle transport code, was used to perform the calculations documented in this ECAR. The ENDF/B-VI and ENDF/B-VII cross-section data libraries [8] [9] were used.

MCNP is archived in the INL Enterprise Architecture (EA) Repository as qualified scientific and engineering analysis software. Table 7 lists the version and CTM UUID's for the release of MCNP and ORIGEN used in this ECAR.

Table 7. INL Qualified Analysis Software, Version, and EA ID.

| Code Name | Version | CTM UUID |
|---|---|---|
| MCNP | 5 (Release 1.60) | 66DB1859-B150-4898-AF8C-374D01595284 |
| ORIGEN | 2.2 | 83837D31-E66F-489D-950D-A09AECFBA8CD |

MCNP Release 1.60 and ORIGEN Version 2.2 have been V&V'd for use by the INL Neutronics Analysis Group as documented in Reference [14].

The computer configuration summarized in Table 8 below was used to perform the MCNP calculations documented in this ECAR.

Table 8. Computer Configurations for INL Qualified MCNP and ORIGEN2 Installation

| Computer | Processor/Hardware | Operating System |
|---|---|---|
| Falcon is a 34992-core SGI ICE X distributed memory cluster with 121 TB of total memory. | Two Intel Xeon E5-2695 v4 CPUs:<br>• Broadwell Chipset<br>• 18 Cores per CPU<br>• 2.10 GHz<br>• 128 GB of RAM<br>FDR InfiniBand Interconnect | SUSE Linux Enterprise Server 12 Service Pack 4 Operating System 3.0.101-108.35-default |

## 8. DISCUSSION/ANALYSIS

The MCNP full core physics model was used to calculate the as-run heat rates, flux and fluence values, and DPA for each of the test specimens within each of the three capsules corresponding to the 3 DPA specimens of the BSU-8242 experiment. The as-run flux values were used to determine the fluence for the experiment based on the irradiation time across all three cycles.

The heating rate values are given below (8.2 Heating Rates); the flux and fluence data follow (8.3 Flux and Fluence Values); finally, the DPA values are tabled (8.4 Displacements Per Atom).

The heating rates ranged from 6.67 to 17.37 $\frac{W}{g}$ in position A-6 (300C 3 DPA Capsule), depending on the material and axial location; the heating rates ranged from 5.14 to 16.38 $\frac{W}{g}$ in the A-7 position (400C 3 DPA (Y)), and the heating rates in the A-8 position (400C 3 DPA (X)) ranged from 5.25 to 9.81 $\frac{W}{g}$. The average neutron flux experienced by the BSU-8242 specimens in position A-6 was ~$9.08\times 10^{14}\frac{n}{cm^2\cdot s}$, while the average fluence was ~$1.47 \times 10^{22}\frac{n}{cm^2}$; The average neutron flux in position A-7 was ~$8.31\times 10^{14}\frac{n}{cm^2\cdot s}$, while the average fluence was ~$1.35 \times 10^{22}\frac{n}{cm^2}$; The average neutron flux in position A-8 was ~$8.65\times 10^{14}\frac{n}{cm^2\cdot s}$, while the average fluence was ~$1.40 \times 10^{22}\frac{n}{cm^2}$. The average DPA experienced by the specimens in the A-6 position was calculated to be 4.65, with the average being 4.32 DPA in the A-7 position, and 3.97 DPA in the A-8 position.

The heat rates are reported to support the thermal analysis in assessing the irradiation temperatures each test specimen experienced. The fluence and DPA values are reported to support PIE. In support of PIE, see excel attachment concomitant with this ECAR, which provides the bounding source terms for each specimen material on a per gram basis.

### 8.1 Power Conditions

The analysis for each cycle employed a model describing an average fuel core loading and average control settings. The as-run flux values were used to determine the fluences for the experiment based on the irradiation time. The values were obtained by scaling the MCNP data to the average Center lobe power obtained from each cycle [1].

The lobe powers along with the EFPD values and the full-core powers are provided in Table 5.

## 8.2 Heating Rates

The following three tables (Tables 9-11) provide the heating rates for each test specimen within each of the 3 DPA capsules. The heat generation rates (HGRs) for the 3 DPA BSU-8242 specimens have been calculated using nominal ATR core power conditions. The HGRs for each test specimen in the BSU-8242 capsules have been calculated at nominal ATR core power conditions using MCNP. These HGR results are scaled to the cycle specific center lobe powers listed in Table 5, which correspond to the as-run operating powers. The HGR results include neutron and gamma heating, as well as delayed gamma heating. Delayed gamma heating was explicitly calculated using a photon only (mode p) MCNP model.

Table 9. Position A-6 specimen heating rates of the upper BSU-8242-300°C/3 DPA capsule analyzed at a Center Lobe Power of 19.7/21.9/22.1 MW per the three cycles.

| **A-6 Position [300C 3 DPA]** | | | | | |
|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | Heating $\left[\frac{W}{g}\right]$ Cycle 1 | Heating $\left[\frac{W}{g}\right]$ Cycle 2 | Heating $\left[\frac{W}{g}\right]$ Cycle 3 |
| RT-690 PM-HIP | 345 | 31.75 | 6.67 | 7.42 | 7.49 |
| RT-690 PM-HIP | 344 | 24.13 | 7.54 | 8.38 | 8.46 |
| RT-625 PM-HIP | 343 | 16.51 | 8.48 | 9.42 | 9.51 |
| RT-625 PM-HIP | 342 | 8.89 | 8.94 | 9.94 | 10.03 |
| CT-625 PM-HIP | 341 | 3.22 | 9.39 | 10.44 | 10.54 |
| CT-625 PM-HIP | 340 | 3.22 | 9.36 | 10.40 | 10.50 |
| TEM-USU-300-3-36 | 339 | 1.39 | 14.60 | 16.23 | 16.38 |
| TEM-USU-300-3-36 | 338 | 1.37 | 14.49 | 16.11 | 16.26 |
| TEM-USU-300-3-36 | 337 | 1.36 | 14.29 | 15.89 | 16.04 |
| TEM-USU-300-3-28 | 336 | 1.34 | 13.13 | 14.60 | 14.73 |
| TEM-USU-300-3-28 | 335 | 1.33 | 13.24 | 14.72 | 14.86 |
| TEM-USU-300-3-28 | 334 | 1.31 | 13.49 | 14.99 | 15.13 |
| TEM-USU-300-3-20 | 333 | 1.30 | 12.03 | 13.37 | 13.50 |
| TEM-USU-300-3-20 | 332 | 1.28 | 12.14 | 13.50 | 13.63 |
| TEM-USU-300-3-20 | 331 | 1.27 | 11.84 | 13.16 | 13.28 |
| TEM-690 Forged | 330 | -1.38 | 8.75 | 9.73 | 9.82 |
| TEM-690 Forged | 329 | -1.39 | 8.73 | 9.71 | 9.80 |
| TEM-690 Forged | 328 | -1.41 | 8.87 | 9.86 | 9.95 |
| TEM-690 Forged | 327 | -1.42 | 8.65 | 9.62 | 9.71 |
| TEM-690 Forged | 326 | -1.44 | 8.56 | 9.51 | 9.60 |
| TEM-690 Forged | 325 | -1.45 | 8.65 | 9.61 | 9.70 |
| TEM-625 Forged | 324 | -1.47 | 9.22 | 10.25 | 10.35 |
| TEM-625 Forged | 323 | -1.48 | 9.20 | 10.23 | 10.33 |
| TEM-625 Forged | 322 | -1.50 | 9.38 | 10.42 | 10.52 |
| TEM-625 Forged | 321 | -1.51 | 9.27 | 10.31 | 10.40 |

| **A-6 Position [300C 3 DPA]** | | | | | |
|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | Heating $\left[\frac{W}{g}\right]$ Cycle 1 | Heating $\left[\frac{W}{g}\right]$ Cycle 2 | Heating $\left[\frac{W}{g}\right]$ Cycle 3 |
| TEM-625 Forged | 320 | -1.53 | 9.20 | 10.23 | 10.33 |
| TEM-625 Forged | 319 | -1.54 | 9.29 | 10.33 | 10.43 |
| TEM-690 PM-HIP | 318 | -1.56 | 8.83 | 9.81 | 9.91 |
| TEM-690 PM-HIP | 317 | -1.57 | 8.87 | 9.86 | 9.96 |
| TEM-690 PM-HIP | 316 | -1.59 | 8.86 | 9.85 | 9.94 |
| TEM-690 PM-HIP | 315 | -1.60 | 8.70 | 9.67 | 9.76 |
| TEM-690 PM-HIP | 314 | -1.62 | 8.66 | 9.63 | 9.72 |
| TEM-690 PM-HIP | 313 | -1.63 | 8.68 | 9.65 | 9.75 |
| TEM-625 PM-HIP | 312 | -1.65 | 9.44 | 10.50 | 10.60 |
| TEM-625 PM-HIP | 311 | -1.66 | 9.38 | 10.43 | 10.53 |
| TEM-625 PM-HIP | 310 | -1.68 | 9.30 | 10.34 | 10.44 |
| TEM-625 PM-HIP | 309 | -1.69 | 9.24 | 10.27 | 10.37 |
| TEM-625 PM-HIP | 308 | -1.71 | 9.30 | 10.34 | 10.44 |
| TEM-625 PM-HIP | 307 | -1.72 | 9.33 | 10.37 | 10.47 |
| CT-625 Cast | 306 | -3.22 | 9.40 | 10.45 | 10.55 |
| CT-625 Cast | 305 | -3.22 | 9.38 | 10.43 | 10.52 |
| RT-625 Forged | 304 | -8.89 | 9.04 | 10.05 | 10.15 |
| RT-625 Forged | 303 | -16.51 | 8.72 | 9.69 | 9.79 |
| RT-690 Forged | 302 | -24.13 | 7.90 | 8.78 | 8.86 |
| RT-690 Forged | 301 | -31.75 | 7.17 | 7.97 | 8.05 |

Table 10. Position A-7 specimen heating rates of the lower BSU-8242-300°C/3 DPA (Y) capsule analyzed at a Center Lobe Power of 19.7/21.9/22.1 MW per the three cycles.

| **A-7 Position [400C 3DPA (Y)]** | | | | | |
|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | Heating $\left[\frac{W}{g}\right]$ Cycle 1 | Heating $\left[\frac{W}{g}\right]$ Cycle 2 | Heating $\left[\frac{W}{g}\right]$ Cycle 3 |
| RT-304L Forged | 723 | 39.37 | 5.14 | 5.72 | 5.77 |
| RT-304L Forged | 722 | 31.75 | 6.10 | 6.78 | 6.84 |
| RT-91 PM-HIP | 721 | 24.13 | 6.89 | 7.65 | 7.73 |
| RT-316L PM-HIP | 720 | 16.51 | 7.55 | 8.39 | 8.47 |
| RT-316L PM-HIP | 719 | 8.89 | 7.94 | 8.82 | 8.91 |
| CT-690 Forged | 718 | 3.22 | 8.44 | 9.38 | 9.47 |
| CT-316 Cast | 717 | 3.22 | 8.25 | 9.17 | 9.26 |

| **A-7 Position [400C 3DPA (Y)]** | | | | | |
|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | Heating $\left[\frac{W}{g}\right]$ Cycle 1 | Heating $\left[\frac{W}{g}\right]$ Cycle 2 | Heating $\left[\frac{W}{g}\right]$ Cycle 3 |
| TEM-USU-400-3-36 | 716 | 1.57 | 14.60 | 16.23 | 16.38 |
| TEM-USU-400-3-36 | 715 | 1.54 | 14.49 | 16.11 | 16.26 |
| TEM-USU-400-3-36 | 714 | 1.51 | 14.29 | 15.89 | 16.04 |
| TEM-USU-400-3-28 | 713 | 1.48 | 13.13 | 14.60 | 14.73 |
| TEM-USU-400-3-28 | 712 | 1.45 | 13.24 | 14.72 | 14.86 |
| TEM-USU-400-3-28 | 711 | 1.42 | 13.49 | 14.99 | 15.13 |
| TEM-USU-400-3-20 | 710 | 1.39 | 12.03 | 13.37 | 13.50 |
| TEM-USU-400-3-20 | 709 | 1.36 | 12.14 | 13.50 | 13.63 |
| TEM-USU-400-3-20 | 708 | 1.33 | 11.84 | 13.16 | 13.28 |
| CT-316 PM-HIP | 707 | -3.22 | 8.31 | 9.24 | 9.33 |
| CT-316 PM-HIP | 706 | -3.22 | 8.32 | 9.25 | 9.34 |
| RT-316L Forged | 705 | -8.89 | 8.01 | 8.90 | 8.99 |
| RT-316L Forged | 704 | -16.51 | 7.73 | 8.60 | 8.68 |
| RT-91 Cast | 703 | -24.13 | 7.20 | 8.00 | 8.08 |
| RT-304L Forged | 702 | -31.75 | 6.55 | 7.28 | 7.35 |
| RT-304L Forged | 701 | -39.37 | 5.71 | 6.34 | 6.40 |

Table 11. Position A-8 specimen heating rates of the upper BSU-8242-400°C/3 DPA (X) capsule analyzed at a Center Lobe Power of 19.7/21.9/22.1 MW per the three cycles.

| **A-8 Position [Lower 400C 3DPA (X)]** | | | | | |
|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | Heating $\left[\frac{W}{g}\right]$ Cycle 1 | Heating $\left[\frac{W}{g}\right]$ Cycle 2 | Heating $\left[\frac{W}{g}\right]$ Cycle 3 |
| RT-690 PM-HIP | 674 | 39.37 | 5.25 | 5.83 | 5.89 |
| RT-690 PM-HIP | 673 | 31.75 | 6.23 | 6.92 | 6.99 |
| RT-625 PM-HIP | 672 | 24.13 | 7.33 | 8.15 | 8.23 |
| RT-625 PM-HIP | 671 | 16.51 | 7.92 | 8.80 | 8.89 |
| RT-91 PM-HIP | 670 | 8.89 | 7.63 | 8.48 | 8.56 |
| CT-625 PM-HIP | 669 | 3.22 | 8.66 | 9.63 | 9.72 |
| CT-625 Cast | 668 | 3.22 | 8.70 | 9.67 | 9.77 |
| TEM-91 Cast | 667 | 1.70 | 7.77 | 8.64 | 8.72 |
| TEM-91 Cast | 666 | 1.69 | 7.86 | 8.73 | 8.82 |
| TEM-91 Cast | 665 | 1.67 | 7.84 | 8.71 | 8.80 |
| TEM-91 Cast | 664 | 1.66 | 7.94 | 8.82 | 8.91 |

| **A-8 Position [Lower 400C 3DPA (X)]** | | | | | |
|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | Heating $\left[\frac{W}{g}\right]$ Cycle 1 | Heating $\left[\frac{W}{g}\right]$ Cycle 2 | Heating $\left[\frac{W}{g}\right]$ Cycle 3 |
| TEM-91 Cast | 663 | 1.64 | 8.13 | 9.04 | 9.13 |
| TEM-91 Cast | 662 | 1.63 | 8.02 | 8.92 | 9.00 |
| TEM-304L Forged | 661 | 1.61 | 7.91 | 8.80 | 8.88 |
| TEM-304L Forged | 660 | 1.60 | 7.92 | 8.80 | 8.88 |
| TEM-304L Forged | 659 | 1.58 | 8.10 | 9.00 | 9.09 |
| TEM-304L Forged | 658 | 1.57 | 8.02 | 8.92 | 9.00 |
| TEM-304L Forged | 657 | 1.55 | 7.83 | 8.71 | 8.79 |
| TEM-304L Forged | 656 | 1.54 | 7.85 | 8.73 | 8.81 |
| TEM-304L Forged | 655 | 1.52 | 7.72 | 8.58 | 8.66 |
| TEM-304L Forged | 654 | 1.51 | 7.79 | 8.66 | 8.74 |
| TEM-304L Forged | 653 | 1.49 | 7.69 | 8.55 | 8.63 |
| TEM-304L Forged | 652 | 1.48 | 7.73 | 8.59 | 8.68 |
| TEM-304L Forged | 651 | 1.46 | 7.70 | 8.56 | 8.64 |
| TEM-304L Forged | 650 | 1.45 | 7.84 | 8.72 | 8.80 |
| TEM-316L PM-HIP | 649 | 1.43 | 8.01 | 8.90 | 8.99 |
| TEM-316L PM-HIP | 648 | 1.42 | 7.92 | 8.80 | 8.89 |
| TEM-316L PM-HIP | 647 | 1.40 | 7.86 | 8.74 | 8.82 |
| TEM-316L PM-HIP | 646 | 1.39 | 7.85 | 8.73 | 8.81 |
| TEM-316L PM-HIP | 645 | 1.37 | 7.88 | 8.76 | 8.85 |
| TEM-316L PM-HIP | 644 | 1.36 | 7.89 | 8.77 | 8.85 |
| TEM-316L Forged | 643 | 1.34 | 8.06 | 8.96 | 9.04 |
| TEM-316L Forged | 642 | 1.33 | 8.16 | 9.07 | 9.15 |
| TEM-316L Forged | 641 | 1.31 | 8.16 | 9.07 | 9.16 |
| TEM-316L Forged | 640 | 1.30 | 8.23 | 9.15 | 9.24 |
| TEM-316L Forged | 639 | 1.28 | 8.07 | 8.97 | 9.05 |
| TEM-316L Forged | 638 | 1.27 | 8.04 | 8.94 | 9.02 |
| TEM-91 PM-HIP | 637 | -1.29 | 7.86 | 8.74 | 8.82 |
| TEM-91 PM-HIP | 636 | -1.30 | 7.88 | 8.76 | 8.84 |
| TEM-91 PM-HIP | 635 | -1.32 | 7.94 | 8.82 | 8.91 |
| TEM-91 PM-HIP | 634 | -1.33 | 7.86 | 8.73 | 8.82 |
| TEM-91 PM-HIP | 633 | -1.35 | 7.91 | 8.79 | 8.88 |
| TEM-91 PM-HIP | 632 | -1.36 | 7.89 | 8.78 | 8.86 |
| TEM-690 Forged | 631 | -1.38 | 8.06 | 8.96 | 9.04 |

| **A-8 Position [Lower 400C 3DPA (X)]** | | | | | |
|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | Heating $\left[\frac{W}{g}\right]$ Cycle 1 | Heating $\left[\frac{W}{g}\right]$ Cycle 2 | Heating $\left[\frac{W}{g}\right]$ Cycle 3 |
| TEM-690 Forged | 630 | -1.39 | 8.16 | 9.07 | 9.16 |
| TEM-690 Forged | 629 | -1.41 | 8.13 | 9.04 | 9.13 |
| TEM-690 Forged | 628 | -1.42 | 8.05 | 8.94 | 9.03 |
| TEM-690 Forged | 627 | -1.44 | 8.19 | 9.11 | 9.19 |
| TEM-690 Forged | 626 | -1.45 | 8.16 | 9.07 | 9.15 |
| TEM-690 PM-HIP | 625 | -1.47 | 8.20 | 9.12 | 9.21 |
| TEM-690 PM-HIP | 624 | -1.48 | 8.09 | 8.99 | 9.08 |
| TEM-690 PM-HIP | 623 | -1.50 | 8.06 | 8.96 | 9.05 |
| TEM-690 PM-HIP | 622 | -1.51 | 8.16 | 9.07 | 9.16 |
| TEM-690 PM-HIP | 621 | -1.53 | 8.14 | 9.05 | 9.13 |
| TEM-690 PM-HIP | 620 | -1.54 | 8.13 | 9.04 | 9.12 |
| TEM-625 Forged | 619 | -1.56 | 8.62 | 9.58 | 9.67 |
| TEM-625 Forged | 618 | -1.57 | 8.67 | 9.64 | 9.73 |
| TEM-625 Forged | 617 | -1.59 | 8.61 | 9.57 | 9.66 |
| TEM-625 Forged | 616 | -1.60 | 8.73 | 9.71 | 9.80 |
| TEM-625 Forged | 615 | -1.62 | 8.69 | 9.66 | 9.76 |
| TEM-625 Forged | 614 | -1.63 | 8.74 | 9.72 | 9.81 |
| TEM-625 PM-HIP | 613 | -1.65 | 8.63 | 9.59 | 9.68 |
| TEM-625 PM-HIP | 612 | -1.66 | 8.55 | 9.51 | 9.60 |
| TEM-625 PM-HIP | 611 | -1.68 | 8.63 | 9.60 | 9.69 |
| TEM-625 PM-HIP | 610 | -1.69 | 8.53 | 9.49 | 9.58 |
| TEM-625 PM-HIP | 609 | -1.71 | 8.63 | 9.59 | 9.68 |
| TEM-625 PM-HIP | 608 | -1.72 | 8.52 | 9.47 | 9.56 |
| CT-690 PM-HIP | 607 | -3.22 | 8.30 | 9.22 | 9.31 |
| CT-690 PM-HIP | 606 | -3.22 | 8.32 | 9.25 | 9.33 |
| RT-91 Cast | 605 | -8.89 | 7.70 | 8.56 | 8.64 |
| RT-625 Forged | 604 | -16.51 | 8.11 | 9.02 | 9.11 |
| RT-625 Forged | 603 | -24.13 | 7.66 | 8.52 | 8.60 |
| RT-690 Forged | 602 | -31.75 | 6.69 | 7.44 | 7.51 |
| RT-690 Forged | 601 | -39.37 | 5.82 | 6.47 | 6.53 |

## 8.3 Flux and Fluence Values

Table 5 displays the cycles and irradiation times for the 3 DPA capsules. Tables 12-14 give the flux (total neutron flux) and fluence data for each specimen throughout the 4 rodlets that were irradiated in Cycles 164B, 166A, and 166B. The fluence data was gathered by integrating the flux values over their respective cycle times, adding the fluence values from each cycle to provide the total neutron fluence data.

Table 12. Position A-6 specimen neutron flux and fluence values of the BSU-8242-300°C/3 DPA capsule analyzed at a Center Lobe Power of 19.7/21.9/22.1 MW per the three cycles.

| **A-6 Position [300C 3DPA]** | | | | | | |
|---|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 1 | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 2 | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 3 | Neutron Fluence $\left[\frac{n}{cm^2}\right]$ Total |
| RT-690 PM-HIP | 345 | 31.75 | 6.57E+14 | 7.31E+14 | 7.37E+14 | 1.15E+22 |
| RT-690 PM-HIP | 344 | 24.13 | 7.44E+14 | 8.27E+14 | 8.35E+14 | 1.30E+22 |
| RT-625 PM-HIP | 343 | 16.51 | 7.95E+14 | 8.84E+14 | 8.92E+14 | 1.39E+22 |
| RT-625 PM-HIP | 342 | 8.89 | 8.33E+14 | 9.26E+14 | 9.35E+14 | 1.46E+22 |
| CT-625 PM-HIP | 341 | 3.22 | 8.54E+14 | 9.49E+14 | 9.58E+14 | 1.49E+22 |
| CT-625 PM-HIP | 340 | 3.22 | 8.55E+14 | 9.51E+14 | 9.60E+14 | 1.49E+22 |
| TEM-USU-300-3-20 | 339 | 1.39 | 8.56E+14 | 9.52E+14 | 9.61E+14 | 1.50E+22 |
| TEM-USU-300-3-20 | 338 | 1.37 | 8.65E+14 | 9.62E+14 | 9.71E+14 | 1.51E+22 |
| TEM-USU-300-3-20 | 337 | 1.36 | 8.70E+14 | 9.67E+14 | 9.76E+14 | 1.52E+22 |
| TEM-USU-300-3-28 | 336 | 1.34 | 8.68E+14 | 9.65E+14 | 9.74E+14 | 1.52E+22 |
| TEM-USU-300-3-28 | 335 | 1.33 | 8.57E+14 | 9.53E+14 | 9.62E+14 | 1.50E+22 |
| TEM-USU-300-3-28 | 334 | 1.31 | 8.58E+14 | 9.54E+14 | 9.63E+14 | 1.50E+22 |
| TEM-USU-300-3-36 | 333 | 1.30 | 8.51E+14 | 9.46E+14 | 9.55E+14 | 1.49E+22 |
| TEM-USU-300-3-36 | 332 | 1.28 | 8.41E+14 | 9.35E+14 | 9.44E+14 | 1.47E+22 |
| TEM-USU-300-3-36 | 331 | 1.27 | 8.41E+14 | 9.35E+14 | 9.44E+14 | 1.47E+22 |
| TEM-690 Forged | 330 | -1.38 | 8.50E+14 | 9.45E+14 | 9.54E+14 | 1.48E+22 |
| TEM-690 Forged | 329 | -1.39 | 8.65E+14 | 9.62E+14 | 9.71E+14 | 1.51E+22 |
| TEM-690 Forged | 328 | -1.41 | 8.75E+14 | 9.73E+14 | 9.82E+14 | 1.53E+22 |
| TEM-690 Forged | 327 | -1.42 | 8.55E+14 | 9.51E+14 | 9.60E+14 | 1.49E+22 |
| TEM-690 Forged | 326 | -1.44 | 8.61E+14 | 9.58E+14 | 9.67E+14 | 1.51E+22 |
| TEM-690 Forged | 325 | -1.45 | 8.65E+14 | 9.61E+14 | 9.70E+14 | 1.51E+22 |
| TEM-625 Forged | 324 | -1.47 | 8.63E+14 | 9.59E+14 | 9.68E+14 | 1.51E+22 |
| TEM-625 Forged | 323 | -1.48 | 8.41E+14 | 9.35E+14 | 9.44E+14 | 1.47E+22 |
| TEM-625 Forged | 322 | -1.50 | 8.57E+14 | 9.53E+14 | 9.62E+14 | 1.50E+22 |
| TEM-625 Forged | 321 | -1.51 | 8.51E+14 | 9.46E+14 | 9.55E+14 | 1.49E+22 |
| TEM-625 Forged | 320 | -1.53 | 8.48E+14 | 9.43E+14 | 9.52E+14 | 1.48E+22 |
| TEM-625 Forged | 319 | -1.54 | 8.56E+14 | 9.52E+14 | 9.61E+14 | 1.50E+22 |

| **A-6 Position [300C 3DPA]** | | | | | | |
|---|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 1 | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 2 | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 3 | Neutron Fluence $\left[\frac{n}{cm^2}\right]$ Total |
| TEM-690 PM-HIP | 318 | -1.56 | 8.41E+14 | 9.35E+14 | 9.43E+14 | 1.47E+22 |
| TEM-690 PM-HIP | 317 | -1.57 | 8.43E+14 | 9.37E+14 | 9.46E+14 | 1.47E+22 |
| TEM-690 PM-HIP | 316 | -1.59 | 8.56E+14 | 9.52E+14 | 9.61E+14 | 1.50E+22 |
| TEM-690 PM-HIP | 315 | -1.60 | 8.53E+14 | 9.48E+14 | 9.57E+14 | 1.49E+22 |
| TEM-690 PM-HIP | 314 | -1.62 | 8.51E+14 | 9.46E+14 | 9.55E+14 | 1.49E+22 |
| TEM-690 PM-HIP | 313 | -1.63 | 8.54E+14 | 9.49E+14 | 9.58E+14 | 1.49E+22 |
| TEM-625 PM-HIP | 312 | -1.65 | 8.69E+14 | 9.66E+14 | 9.75E+14 | 1.52E+22 |
| TEM-625 PM-HIP | 311 | -1.66 | 8.69E+14 | 9.66E+14 | 9.75E+14 | 1.52E+22 |
| TEM-625 PM-HIP | 310 | -1.68 | 8.71E+14 | 9.69E+14 | 9.78E+14 | 1.52E+22 |
| TEM-625 PM-HIP | 309 | -1.69 | 8.75E+14 | 9.73E+14 | 9.82E+14 | 1.53E+22 |
| TEM-625 PM-HIP | 308 | -1.71 | 8.85E+14 | 9.83E+14 | 9.93E+14 | 1.55E+22 |
| TEM-625 PM-HIP | 307 | -1.72 | 8.67E+14 | 9.63E+14 | 9.72E+14 | 1.51E+22 |
| CT-625 Cast | 306 | -3.22 | 8.56E+14 | 9.51E+14 | 9.60E+14 | 1.50E+22 |
| CT-625 Cast | 305 | -3.22 | 8.56E+14 | 9.51E+14 | 9.60E+14 | 1.50E+22 |
| RT-625 Forged | 304 | -8.89 | 8.40E+14 | 9.34E+14 | 9.43E+14 | 1.47E+22 |
| RT-625 Forged | 303 | -16.51 | 8.15E+14 | 9.06E+14 | 9.14E+14 | 1.42E+22 |
| RT-690 Forged | 302 | -24.13 | 7.77E+14 | 8.64E+14 | 8.72E+14 | 1.36E+22 |
| RT-690 Forged | 301 | -31.75 | 7.07E+14 | 7.86E+14 | 7.93E+14 | 1.24E+22 |

Table 13. Position A-7 specimen neutron flux and fluence values of the BSU-8242-400°C/3 DPA (Y) capsule analyzed at a Center Lobe Power of 19.7/21.9/22.1 MW per the three cycles.

| **A-7 Position [400C 3DPA (Y)]** | | | | | | |
|---|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 1 | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 2 | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 3 | Neutron Fluence $\left[\frac{n}{cm^2}\right]$ Total |
| RT-304L Forged | 723 | 39.37 | 5.39E+14 | 5.99E+14 | 6.05E+14 | 9.42E+21 |
| RT-304L Forged | 722 | 31.75 | 6.38E+14 | 7.09E+14 | 7.16E+14 | 1.11E+22 |
| RT-91 PM-HIP | 721 | 24.13 | 7.21E+14 | 8.02E+14 | 8.09E+14 | 1.26E+22 |
| RT-316L PM-HIP | 720 | 16.51 | 7.73E+14 | 8.59E+14 | 8.67E+14 | 1.35E+22 |
| RT-316L PM-HIP | 719 | 8.89 | 8.07E+14 | 8.97E+14 | 9.06E+14 | 1.41E+22 |
| CT-690 Forged | 718 | 3.22 | 8.24E+14 | 9.16E+14 | 9.24E+14 | 1.44E+22 |
| CT-316 Cast | 717 | 3.22 | 8.24E+14 | 9.16E+14 | 9.25E+14 | 1.44E+22 |
| TEM-USU-400-3-36 | 716 | 1.57 | 8.20E+14 | 9.12E+14 | 9.20E+14 | 1.43E+22 |

| **A-7 Position [400C 3DPA (Y)]** | | | | | | |
|---|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 1 | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 2 | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 3 | Neutron Fluence $\left[\frac{n}{cm^2}\right]$ Total |
| TEM-USU-400-3-36 | 715 | 1.54 | 8.31E+14 | 9.24E+14 | 9.33E+14 | 1.45E+22 |
| TEM-USU-400-3-36 | 714 | 1.51 | 8.29E+14 | 9.21E+14 | 9.30E+14 | 1.45E+22 |
| TEM-USU-400-3-28 | 713 | 1.48 | 8.12E+14 | 9.03E+14 | 9.11E+14 | 1.42E+22 |
| TEM-USU-400-3-28 | 712 | 1.45 | 8.03E+14 | 8.93E+14 | 9.02E+14 | 1.40E+22 |
| TEM-USU-400-3-28 | 711 | 1.42 | 8.05E+14 | 8.95E+14 | 9.04E+14 | 1.41E+22 |
| TEM-USU-400-3-20 | 710 | 1.39 | 8.01E+14 | 8.91E+14 | 8.99E+14 | 1.40E+22 |
| TEM-USU-400-3-20 | 709 | 1.36 | 8.03E+14 | 8.92E+14 | 9.01E+14 | 1.40E+22 |
| TEM-USU-400-3-20 | 708 | 1.33 | 8.06E+14 | 8.96E+14 | 9.04E+14 | 1.41E+22 |
| CT-316 PM-HIP | 707 | -3.22 | 8.30E+14 | 9.22E+14 | 9.31E+14 | 1.45E+22 |
| CT-316 PM-HIP | 706 | -3.22 | 8.30E+14 | 9.22E+14 | 9.31E+14 | 1.45E+22 |
| RT-316L Forged | 705 | -8.89 | 8.13E+14 | 9.04E+14 | 9.13E+14 | 1.42E+22 |
| RT-316L Forged | 704 | -16.51 | 7.89E+14 | 8.77E+14 | 8.85E+14 | 1.38E+22 |
| RT-91 Cast | 703 | -24.13 | 7.52E+14 | 8.36E+14 | 8.44E+14 | 1.31E+22 |
| RT-304L Forged | 702 | -31.75 | 6.82E+14 | 7.58E+14 | 7.65E+14 | 1.19E+22 |
| RT-304L Forged | 701 | -39.37 | 5.97E+14 | 6.63E+14 | 6.70E+14 | 1.04E+22 |

Table 14. Position A-8 specimen neutron flux and fluence values of the BSU-8242-400°C/3 DPA (X) capsule analyzed at a Center Lobe Power of 19.7/21.9/22.1 MW per the three cycles.

| **A-8 Position [400C 3DPA (X)]** | | | | | | |
|---|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 1 | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 2 | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 3 | Neutron Fluence $\left[\frac{n}{cm^2}\right]$ Total |
| RT-690 PM-HIP | 674 | 39.37 | 5.27E+14 | 5.86E+14 | 5.92E+14 | 9.21E+21 |
| RT-690 PM-HIP | 673 | 31.75 | 6.24E+14 | 6.93E+14 | 7.00E+14 | 1.09E+22 |
| RT-625 PM-HIP | 672 | 24.13 | 7.01E+14 | 7.79E+14 | 7.86E+14 | 1.22E+22 |
| RT-625 PM-HIP | 671 | 16.51 | 7.51E+14 | 8.35E+14 | 8.43E+14 | 1.31E+22 |
| RT-91 PM-HIP | 670 | 8.89 | 7.97E+14 | 8.86E+14 | 8.94E+14 | 1.39E+22 |
| CT-625 PM-HIP | 669 | 3.22 | 8.08E+14 | 8.98E+14 | 9.06E+14 | 1.41E+22 |
| CT-625 Cast | 668 | 3.22 | 8.10E+14 | 9.00E+14 | 9.09E+14 | 1.42E+22 |
| TEM-91 Cast | 667 | 1.70 | 8.20E+14 | 9.11E+14 | 9.20E+14 | 1.43E+22 |
| TEM-91 Cast | 666 | 1.69 | 8.24E+14 | 9.16E+14 | 9.25E+14 | 1.44E+22 |
| TEM-91 Cast | 665 | 1.67 | 8.17E+14 | 9.09E+14 | 9.17E+14 | 1.43E+22 |
| TEM-91 Cast | 664 | 1.66 | 8.15E+14 | 9.06E+14 | 9.15E+14 | 1.42E+22 |

| **A-8 Position [400C 3DPA (X)]** | | | | | | |
|---|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 1 | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 2 | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 3 | Neutron Fluence $\left[\frac{n}{cm^2}\right]$ Total |
| TEM-91 Cast | 663 | 1.64 | 8.09E+14 | 8.99E+14 | 9.07E+14 | 1.41E+22 |
| TEM-91 Cast | 662 | 1.63 | 8.19E+14 | 9.10E+14 | 9.19E+14 | 1.43E+22 |
| TEM-304L Forged | 661 | 1.61 | 8.19E+14 | 9.10E+14 | 9.19E+14 | 1.43E+22 |
| TEM-304L Forged | 660 | 1.60 | 8.22E+14 | 9.14E+14 | 9.23E+14 | 1.44E+22 |
| TEM-304L Forged | 659 | 1.58 | 8.36E+14 | 9.30E+14 | 9.38E+14 | 1.46E+22 |
| TEM-304L Forged | 658 | 1.57 | 8.30E+14 | 9.22E+14 | 9.31E+14 | 1.45E+22 |
| TEM-304L Forged | 657 | 1.55 | 8.34E+14 | 9.27E+14 | 9.36E+14 | 1.46E+22 |
| TEM-304L Forged | 656 | 1.54 | 8.25E+14 | 9.18E+14 | 9.26E+14 | 1.44E+22 |
| TEM-304L Forged | 655 | 1.52 | 8.36E+14 | 9.30E+14 | 9.38E+14 | 1.46E+22 |
| TEM-304L Forged | 654 | 1.51 | 8.28E+14 | 9.20E+14 | 9.29E+14 | 1.45E+22 |
| TEM-304L Forged | 653 | 1.49 | 8.26E+14 | 9.18E+14 | 9.27E+14 | 1.44E+22 |
| TEM-304L Forged | 652 | 1.48 | 8.24E+14 | 9.16E+14 | 9.25E+14 | 1.44E+22 |
| TEM-304L Forged | 651 | 1.46 | 8.30E+14 | 9.22E+14 | 9.31E+14 | 1.45E+22 |
| TEM-304L Forged | 650 | 1.45 | 8.31E+14 | 9.24E+14 | 9.33E+14 | 1.45E+22 |
| TEM-316L PM-HIP | 649 | 1.43 | 8.31E+14 | 9.24E+14 | 9.33E+14 | 1.45E+22 |
| TEM-316L PM-HIP | 648 | 1.42 | 8.33E+14 | 9.26E+14 | 9.35E+14 | 1.46E+22 |
| TEM-316L PM-HIP | 647 | 1.40 | 8.36E+14 | 9.30E+14 | 9.38E+14 | 1.46E+22 |
| TEM-316L PM-HIP | 646 | 1.39 | 8.31E+14 | 9.24E+14 | 9.33E+14 | 1.45E+22 |
| TEM-316L PM-HIP | 645 | 1.37 | 8.34E+14 | 9.27E+14 | 9.35E+14 | 1.46E+22 |
| TEM-316L PM-HIP | 644 | 1.36 | 8.32E+14 | 9.25E+14 | 9.33E+14 | 1.45E+22 |
| TEM-316L Forged | 643 | 1.34 | 8.36E+14 | 9.29E+14 | 9.38E+14 | 1.46E+22 |
| TEM-316L Forged | 642 | 1.33 | 8.37E+14 | 9.30E+14 | 9.39E+14 | 1.46E+22 |
| TEM-316L Forged | 641 | 1.31 | 8.33E+14 | 9.26E+14 | 9.35E+14 | 1.46E+22 |
| TEM-316L Forged | 640 | 1.30 | 8.23E+14 | 9.15E+14 | 9.24E+14 | 1.44E+22 |
| TEM-316L Forged | 639 | 1.28 | 8.15E+14 | 9.06E+14 | 9.14E+14 | 1.42E+22 |
| TEM-316L Forged | 638 | 1.27 | 8.13E+14 | 9.03E+14 | 9.12E+14 | 1.42E+22 |
| TEM-91 PM-HIP | 637 | -1.29 | 8.11E+14 | 9.01E+14 | 9.10E+14 | 1.42E+22 |
| TEM-91 PM-HIP | 636 | -1.30 | 8.23E+14 | 9.15E+14 | 9.23E+14 | 1.44E+22 |
| TEM-91 PM-HIP | 635 | -1.32 | 8.06E+14 | 8.96E+14 | 9.05E+14 | 1.41E+22 |
| TEM-91 PM-HIP | 634 | -1.33 | 7.99E+14 | 8.89E+14 | 8.97E+14 | 1.40E+22 |
| TEM-91 PM-HIP | 633 | -1.35 | 7.93E+14 | 8.82E+14 | 8.90E+14 | 1.39E+22 |
| TEM-91 PM-HIP | 632 | -1.36 | 8.08E+14 | 8.98E+14 | 9.06E+14 | 1.41E+22 |
| TEM-690 Forged | 631 | -1.38 | 8.13E+14 | 9.04E+14 | 9.13E+14 | 1.42E+22 |

| **A-8 Position [400C 3DPA (X)]** | | | | | | |
|---|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 1 | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 2 | Neutron Flux $\left[\frac{n}{cm^2 \cdot s}\right]$ Cycle 3 | Neutron Fluence $\left[\frac{n}{cm^2}\right]$ Total |
| TEM-690 Forged | 630 | -1.39 | 8.26E+14 | 9.18E+14 | 9.27E+14 | 1.44E+22 |
| TEM-690 Forged | 629 | -1.41 | 8.19E+14 | 9.11E+14 | 9.20E+14 | 1.43E+22 |
| TEM-690 Forged | 628 | -1.42 | 8.26E+14 | 9.18E+14 | 9.27E+14 | 1.44E+22 |
| TEM-690 Forged | 627 | -1.44 | 8.12E+14 | 9.03E+14 | 9.11E+14 | 1.42E+22 |
| TEM-690 Forged | 626 | -1.45 | 8.16E+14 | 9.07E+14 | 9.16E+14 | 1.43E+22 |
| TEM-690 PM-HIP | 625 | -1.47 | 8.23E+14 | 9.15E+14 | 9.23E+14 | 1.44E+22 |
| TEM-690 PM-HIP | 624 | -1.48 | 8.14E+14 | 9.05E+14 | 9.14E+14 | 1.42E+22 |
| TEM-690 PM-HIP | 623 | -1.50 | 8.11E+14 | 9.01E+14 | 9.10E+14 | 1.42E+22 |
| TEM-690 PM-HIP | 622 | -1.51 | 8.17E+14 | 9.09E+14 | 9.17E+14 | 1.43E+22 |
| TEM-690 PM-HIP | 621 | -1.53 | 8.15E+14 | 9.07E+14 | 9.15E+14 | 1.43E+22 |
| TEM-690 PM-HIP | 620 | -1.54 | 8.08E+14 | 8.98E+14 | 9.07E+14 | 1.41E+22 |
| TEM-625 Forged | 619 | -1.56 | 8.21E+14 | 9.13E+14 | 9.21E+14 | 1.43E+22 |
| TEM-625 Forged | 618 | -1.57 | 8.25E+14 | 9.18E+14 | 9.26E+14 | 1.44E+22 |
| TEM-625 Forged | 617 | -1.59 | 8.29E+14 | 9.22E+14 | 9.31E+14 | 1.45E+22 |
| TEM-625 Forged | 616 | -1.60 | 8.09E+14 | 8.99E+14 | 9.08E+14 | 1.41E+22 |
| TEM-625 Forged | 615 | -1.62 | 8.02E+14 | 8.92E+14 | 9.00E+14 | 1.40E+22 |
| TEM-625 Forged | 614 | -1.63 | 7.93E+14 | 8.81E+14 | 8.90E+14 | 1.39E+22 |
| TEM-625 PM-HIP | 613 | -1.65 | 8.05E+14 | 8.95E+14 | 9.03E+14 | 1.41E+22 |
| TEM-625 PM-HIP | 612 | -1.66 | 8.02E+14 | 8.92E+14 | 9.00E+14 | 1.40E+22 |
| TEM-625 PM-HIP | 611 | -1.68 | 8.03E+14 | 8.93E+14 | 9.01E+14 | 1.40E+22 |
| TEM-625 PM-HIP | 610 | -1.69 | 8.00E+14 | 8.90E+14 | 8.98E+14 | 1.40E+22 |
| TEM-625 PM-HIP | 609 | -1.71 | 8.14E+14 | 9.05E+14 | 9.13E+14 | 1.42E+22 |
| TEM-625 PM-HIP | 608 | -1.72 | 8.20E+14 | 9.12E+14 | 9.21E+14 | 1.43E+22 |
| CT-690 PM-HIP | 607 | -3.22 | 8.10E+14 | 9.00E+14 | 9.09E+14 | 1.41E+22 |
| CT-690 PM-HIP | 606 | -3.22 | 8.10E+14 | 9.00E+14 | 9.09E+14 | 1.41E+22 |
| RT-91 Cast | 605 | -8.89 | 8.03E+14 | 8.93E+14 | 9.01E+14 | 1.40E+22 |
| RT-625 Forged | 604 | -16.51 | 7.69E+14 | 8.55E+14 | 8.63E+14 | 1.34E+22 |
| RT-625 Forged | 603 | -24.13 | 7.30E+14 | 8.12E+14 | 8.19E+14 | 1.28E+22 |
| RT-690 Forged | 602 | -31.75 | 6.68E+14 | 7.42E+14 | 7.50E+14 | 1.17E+22 |
| RT-690 Forged | 601 | -39.37 | 5.85E+14 | 6.51E+14 | 6.57E+14 | 1.02E+22 |

## 8.4 Displacements Per Atom

The following three tables (Tables 15-17) provide the DPA values for each test specimen within each of the capsules. The tally output data was scaled to the appropriate lobe powers specific to each cycle.

Table 15. Position A-6 specimen DPA values of the BSU-8242-300°C/3 DPA capsule analyzed at a Center Lobe Power of 19.7/21.9/22.1 MW per the three cycles.

| **A-6 Position [300C 3DPA]** | | | | | | |
|---|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | DPA Cycle 1 | DPA Cycle 2 | DPA Cycle 3 | Total DPA |
| RT-690 PM-HIP | 345 | 31.75 | 1.12 | 1.21 | 1.20 | 3.53 |
| RT-690 PM-HIP | 344 | 24.13 | 1.26 | 1.36 | 1.35 | 3.96 |
| RT-625 PM-HIP | 343 | 16.51 | 1.34 | 1.45 | 1.44 | 4.23 |
| RT-625 PM-HIP | 342 | 8.89 | 1.39 | 1.51 | 1.49 | 4.40 |
| CT-625 PM-HIP | 341 | 3.22 | 1.42 | 1.54 | 1.52 | 4.47 |
| CT-625 PM-HIP | 340 | 3.22 | 1.42 | 1.54 | 1.52 | 4.48 |
| TEM-USU-300-3-20 | 339 | 1.39 | 1.98 | 2.14 | 2.12 | 6.24 |
| TEM-USU-300-3-20 | 338 | 1.37 | 1.97 | 2.13 | 2.11 | 6.21 |
| TEM-USU-300-3-20 | 337 | 1.36 | 1.98 | 2.15 | 2.13 | 6.26 |
| TEM-USU-300-3-28 | 336 | 1.34 | 1.89 | 2.05 | 2.02 | 5.96 |
| TEM-USU-300-3-28 | 335 | 1.33 | 1.82 | 1.98 | 1.95 | 5.75 |
| TEM-USU-300-3-28 | 334 | 1.31 | 1.79 | 1.94 | 1.92 | 5.66 |
| TEM-USU-300-3-36 | 333 | 1.30 | 1.70 | 1.84 | 1.82 | 5.37 |
| TEM-USU-300-3-36 | 332 | 1.28 | 1.70 | 1.84 | 1.82 | 5.35 |
| TEM-USU-300-3-36 | 331 | 1.27 | 1.72 | 1.87 | 1.84 | 5.43 |
| TEM-690 Forged | 330 | -1.38 | 1.59 | 1.72 | 1.70 | 5.01 |
| TEM-690 Forged | 329 | -1.39 | 1.46 | 1.59 | 1.57 | 4.61 |
| TEM-690 Forged | 328 | -1.41 | 1.44 | 1.56 | 1.54 | 4.55 |
| TEM-690 Forged | 327 | -1.42 | 1.43 | 1.55 | 1.54 | 4.52 |
| TEM-690 Forged | 326 | -1.44 | 1.45 | 1.57 | 1.55 | 4.56 |
| TEM-690 Forged | 325 | -1.45 | 1.43 | 1.55 | 1.54 | 4.52 |
| TEM-625 Forged | 324 | -1.47 | 1.46 | 1.58 | 1.56 | 4.60 |
| TEM-625 Forged | 323 | -1.48 | 1.42 | 1.54 | 1.52 | 4.47 |
| TEM-625 Forged | 322 | -1.50 | 1.42 | 1.54 | 1.52 | 4.49 |
| TEM-625 Forged | 321 | -1.51 | 1.41 | 1.53 | 1.51 | 4.46 |
| TEM-625 Forged | 320 | -1.53 | 1.39 | 1.51 | 1.49 | 4.39 |
| TEM-625 Forged | 319 | -1.54 | 1.46 | 1.59 | 1.57 | 4.62 |
| TEM-690 PM-HIP | 318 | -1.56 | 1.40 | 1.52 | 1.50 | 4.42 |
| TEM-690 PM-HIP | 317 | -1.57 | 1.41 | 1.53 | 1.52 | 4.46 |

| A-6 Position [300C 3DPA] | | | | | | |
|---|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | DPA Cycle 1 | DPA Cycle 2 | DPA Cycle 3 | Total DPA |
| TEM-690 PM-HIP | 316 | -1.59 | 1.37 | 1.49 | 1.47 | 4.33 |
| TEM-690 PM-HIP | 315 | -1.60 | 1.39 | 1.51 | 1.49 | 4.40 |
| TEM-690 PM-HIP | 314 | -1.62 | 1.42 | 1.53 | 1.52 | 4.47 |
| TEM-690 PM-HIP | 313 | -1.63 | 1.42 | 1.54 | 1.52 | 4.48 |
| TEM-625 PM-HIP | 312 | -1.65 | 1.45 | 1.57 | 1.55 | 4.57 |
| TEM-625 PM-HIP | 311 | -1.66 | 1.45 | 1.58 | 1.56 | 4.59 |
| TEM-625 PM-HIP | 310 | -1.68 | 1.44 | 1.56 | 1.55 | 4.55 |
| TEM-625 PM-HIP | 309 | -1.69 | 1.42 | 1.54 | 1.52 | 4.48 |
| TEM-625 PM-HIP | 308 | -1.71 | 1.46 | 1.58 | 1.56 | 4.60 |
| TEM-625 PM-HIP | 307 | -1.72 | 1.40 | 1.51 | 1.49 | 4.40 |
| CT-625 Cast | 306 | -3.22 | 1.42 | 1.54 | 1.52 | 4.48 |
| CT-625 Cast | 305 | -3.22 | 1.42 | 1.54 | 1.52 | 4.47 |
| RT-625 Forged | 304 | -8.89 | 1.41 | 1.52 | 1.51 | 4.43 |
| RT-625 Forged | 303 | -16.51 | 1.37 | 1.48 | 1.47 | 4.32 |
| RT-690 Forged | 302 | -24.13 | 1.31 | 1.42 | 1.40 | 4.13 |
| RT-690 Forged | 301 | -31.75 | 1.20 | 1.30 | 1.29 | 3.79 |

Table 16. Position A-7 specimen DPA values of the BSU-8242-400°C/3 DPA (Y) capsule analyzed at a Center Lobe Power of 19.7/21.9/22.1 MW per the three cycles.

| A-7 Position [400C 3DPA (Y)] | | | | | | |
|---|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | DPA Cycle 1 | DPA Cycle 2 | DPA Cycle 3 | Total DPA |
| RT-304L Forged | 723 | 39.37 | 0.86 | 0.93 | 0.92 | 2.70 |
| RT-304L Forged | 722 | 31.75 | 1.00 | 1.08 | 1.07 | 3.15 |
| RT-91 PM-HIP | 721 | 24.13 | 1.08 | 1.17 | 1.15 | 3.40 |
| RT-316L PM-HIP | 720 | 16.51 | 1.19 | 1.30 | 1.28 | 3.77 |
| RT-316L PM-HIP | 719 | 8.89 | 1.24 | 1.34 | 1.33 | 3.91 |
| CT-690 Forged | 718 | 3.22 | 1.35 | 1.46 | 1.45 | 4.26 |
| CT-316 Cast | 717 | 3.22 | 1.27 | 1.37 | 1.36 | 4.00 |
| TEM-USU-400-3-36 | 716 | 1.57 | 1.59 | 1.72 | 1.70 | 5.01 |
| TEM-USU-400-3-36 | 715 | 1.54 | 1.60 | 1.73 | 1.71 | 5.04 |
| TEM-USU-400-3-36 | 714 | 1.51 | 1.57 | 1.70 | 1.68 | 4.95 |
| TEM-USU-400-3-28 | 713 | 1.48 | 1.70 | 1.84 | 1.82 | 5.36 |

| A-7 Position [400C 3DPA (Y)] | | | | | | |
|---|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | DPA Cycle 1 | DPA Cycle 2 | DPA Cycle 3 | Total DPA |
| TEM-USU-400-3-28 | 712 | 1.45 | 1.71 | 1.85 | 1.83 | 5.38 |
| TEM-USU-400-3-28 | 711 | 1.42 | 1.71 | 1.85 | 1.83 | 5.38 |
| TEM-USU-400-3-20 | 710 | 1.39 | 1.87 | 2.03 | 2.00 | 5.90 |
| TEM-USU-400-3-20 | 709 | 1.36 | 1.84 | 2.00 | 1.98 | 5.82 |
| TEM-USU-400-3-20 | 708 | 1.33 | 1.81 | 1.96 | 1.94 | 5.72 |
| CT-316 PM-HIP | 707 | -3.22 | 1.27 | 1.37 | 1.36 | 4.00 |
| CT-316 PM-HIP | 706 | -3.22 | 1.26 | 1.37 | 1.35 | 3.99 |
| RT-316L Forged | 705 | -8.89 | 1.25 | 1.35 | 1.34 | 3.94 |
| RT-316L Forged | 704 | -16.51 | 1.22 | 1.32 | 1.30 | 3.84 |
| RT-91 Cast | 703 | -24.13 | 1.12 | 1.22 | 1.20 | 3.54 |
| RT-304L Forged | 702 | -31.75 | 1.07 | 1.15 | 1.14 | 3.36 |
| RT-304L Forged | 701 | -39.37 | 0.95 | 1.02 | 1.01 | 2.98 |

Table 17. Position A-8 specimen DPA values of the BSU-8242-400°C/3 DPA (X) capsule analyzed at a Center Lobe Power of 19.7/21.9/22.1 MW per the three cycles.

| A-8 Position [400C 3DPA (X)] | | | | | | |
|---|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | DPA Cycle 1 | DPA Cycle 2 | DPA Cycle 3 | Total DPA |
| RT-690 PM-HIP | 674 | 39.37 | 0.89 | 0.97 | 0.96 | 2.82 |
| RT-690 PM-HIP | 673 | 31.75 | 1.04 | 1.13 | 1.12 | 3.29 |
| RT-625 PM-HIP | 672 | 24.13 | 1.17 | 1.27 | 1.25 | 3.69 |
| RT-625 PM-HIP | 671 | 16.51 | 1.25 | 1.35 | 1.33 | 3.93 |
| RT-91 PM-HIP | 670 | 8.89 | 1.17 | 1.27 | 1.25 | 3.68 |
| CT-625 PM-HIP | 669 | 3.22 | 1.32 | 1.43 | 1.41 | 4.16 |
| CT-625 Cast | 668 | 3.22 | 1.31 | 1.42 | 1.40 | 4.13 |
| TEM-91 Cast | 667 | 1.70 | 1.26 | 1.36 | 1.35 | 3.96 |
| TEM-91 Cast | 666 | 1.69 | 1.26 | 1.37 | 1.35 | 3.98 |
| TEM-91 Cast | 665 | 1.67 | 1.26 | 1.36 | 1.35 | 3.97 |
| TEM-91 Cast | 664 | 1.66 | 1.26 | 1.37 | 1.35 | 3.99 |
| TEM-91 Cast | 663 | 1.64 | 1.24 | 1.34 | 1.33 | 3.91 |
| TEM-91 Cast | 662 | 1.63 | 1.27 | 1.37 | 1.36 | 3.99 |
| TEM-304L Forged | 661 | 1.61 | 1.24 | 1.34 | 1.33 | 3.91 |
| TEM-304L Forged | 660 | 1.60 | 1.26 | 1.36 | 1.35 | 3.96 |

| **A-8 Position [400C 3DPA (X)]** | | | | | | |
|---|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | DPA Cycle 1 | DPA Cycle 2 | DPA Cycle 3 | Total DPA |
| TEM-304L Forged | 659 | 1.58 | 1.30 | 1.41 | 1.40 | 4.11 |
| TEM-304L Forged | 658 | 1.57 | 1.28 | 1.38 | 1.37 | 4.03 |
| TEM-304L Forged | 657 | 1.55 | 1.28 | 1.39 | 1.38 | 4.05 |
| TEM-304L Forged | 656 | 1.54 | 1.27 | 1.38 | 1.36 | 4.02 |
| TEM-304L Forged | 655 | 1.52 | 1.25 | 1.36 | 1.34 | 3.95 |
| TEM-304L Forged | 654 | 1.51 | 1.25 | 1.36 | 1.34 | 3.95 |
| TEM-304L Forged | 653 | 1.49 | 1.23 | 1.33 | 1.32 | 3.87 |
| TEM-304L Forged | 652 | 1.48 | 1.28 | 1.39 | 1.37 | 4.03 |
| TEM-304L Forged | 651 | 1.46 | 1.27 | 1.37 | 1.36 | 4.00 |
| TEM-304L Forged | 650 | 1.45 | 1.28 | 1.38 | 1.37 | 4.03 |
| TEM-316L PM-HIP | 649 | 1.43 | 1.26 | 1.37 | 1.35 | 3.98 |
| TEM-316L PM-HIP | 648 | 1.42 | 1.26 | 1.37 | 1.35 | 3.98 |
| TEM-316L PM-HIP | 647 | 1.40 | 1.25 | 1.36 | 1.34 | 3.95 |
| TEM-316L PM-HIP | 646 | 1.39 | 1.26 | 1.36 | 1.35 | 3.96 |
| TEM-316L PM-HIP | 645 | 1.37 | 1.27 | 1.38 | 1.36 | 4.00 |
| TEM-316L PM-HIP | 644 | 1.36 | 1.31 | 1.42 | 1.40 | 4.13 |
| TEM-316L Forged | 643 | 1.34 | 1.25 | 1.36 | 1.34 | 3.95 |
| TEM-316L Forged | 642 | 1.33 | 1.23 | 1.33 | 1.32 | 3.88 |
| TEM-316L Forged | 641 | 1.31 | 1.24 | 1.34 | 1.33 | 3.91 |
| TEM-316L Forged | 640 | 1.30 | 1.21 | 1.31 | 1.29 | 3.81 |
| TEM-316L Forged | 639 | 1.28 | 1.18 | 1.28 | 1.27 | 3.73 |
| TEM-316L Forged | 638 | 1.27 | 1.17 | 1.27 | 1.25 | 3.69 |
| TEM-91 PM-HIP | 637 | -1.29 | 1.17 | 1.27 | 1.25 | 3.70 |
| TEM-91 PM-HIP | 636 | -1.30 | 1.24 | 1.35 | 1.33 | 3.92 |
| TEM-91 PM-HIP | 635 | -1.32 | 1.20 | 1.30 | 1.28 | 3.78 |
| TEM-91 PM-HIP | 634 | -1.33 | 1.20 | 1.30 | 1.29 | 3.80 |
| TEM-91 PM-HIP | 633 | -1.35 | 1.15 | 1.25 | 1.24 | 3.64 |
| TEM-91 PM-HIP | 632 | -1.36 | 1.14 | 1.24 | 1.22 | 3.60 |
| TEM-690 Forged | 631 | -1.38 | 1.27 | 1.38 | 1.36 | 4.02 |
| TEM-690 Forged | 630 | -1.39 | 1.29 | 1.40 | 1.39 | 4.09 |
| TEM-690 Forged | 629 | -1.41 | 1.31 | 1.42 | 1.40 | 4.14 |
| TEM-690 Forged | 628 | -1.42 | 1.34 | 1.45 | 1.44 | 4.23 |
| TEM-690 Forged | 627 | -1.44 | 1.29 | 1.40 | 1.38 | 4.07 |

| **A-8 Position [400C 3DPA (X)]** | | | | | | |
|---|---|---|---|---|---|---|
| Specimen/Material | Specimen Number | Distance from Core Midplane (cm) | DPA Cycle 1 | DPA Cycle 2 | DPA Cycle 3 | Total DPA |
| TEM-690 Forged | 626 | -1.45 | 1.30 | 1.41 | 1.40 | 4.11 |
| TEM-690 PM-HIP | 625 | -1.47 | 1.33 | 1.44 | 1.43 | 4.20 |
| TEM-690 PM-HIP | 624 | -1.48 | 1.33 | 1.44 | 1.42 | 4.18 |
| TEM-690 PM-HIP | 623 | -1.50 | 1.28 | 1.39 | 1.37 | 4.05 |
| TEM-690 PM-HIP | 622 | -1.51 | 1.30 | 1.41 | 1.40 | 4.11 |
| TEM-690 PM-HIP | 621 | -1.53 | 1.30 | 1.41 | 1.40 | 4.11 |
| TEM-690 PM-HIP | 620 | -1.54 | 1.33 | 1.44 | 1.42 | 4.18 |
| TEM-625 Forged | 619 | -1.56 | 1.34 | 1.45 | 1.43 | 4.22 |
| TEM-625 Forged | 618 | -1.57 | 1.34 | 1.45 | 1.43 | 4.21 |
| TEM-625 Forged | 617 | -1.59 | 1.37 | 1.48 | 1.46 | 4.31 |
| TEM-625 Forged | 616 | -1.60 | 1.35 | 1.46 | 1.44 | 4.25 |
| TEM-625 Forged | 615 | -1.62 | 1.31 | 1.42 | 1.40 | 4.13 |
| TEM-625 Forged | 614 | -1.63 | 1.29 | 1.40 | 1.38 | 4.06 |
| TEM-625 PM-HIP | 613 | -1.65 | 1.33 | 1.44 | 1.42 | 4.19 |
| TEM-625 PM-HIP | 612 | -1.66 | 1.32 | 1.43 | 1.42 | 4.17 |
| TEM-625 PM-HIP | 611 | -1.68 | 1.35 | 1.47 | 1.45 | 4.28 |
| TEM-625 PM-HIP | 610 | -1.69 | 1.35 | 1.46 | 1.44 | 4.25 |
| TEM-625 PM-HIP | 609 | -1.71 | 1.37 | 1.49 | 1.47 | 4.33 |
| TEM-625 PM-HIP | 608 | -1.72 | 1.39 | 1.51 | 1.49 | 4.40 |
| CT-690 PM-HIP | 607 | -3.22 | 1.32 | 1.43 | 1.41 | 4.16 |
| CT-690 PM-HIP | 606 | -3.22 | 1.32 | 1.43 | 1.42 | 4.17 |
| RT-91 Cast | 605 | -8.89 | 1.18 | 1.28 | 1.26 | 3.71 |
| RT-625 Forged | 604 | -16.51 | 1.27 | 1.38 | 1.36 | 4.01 |
| RT-625 Forged | 603 | -24.13 | 1.22 | 1.32 | 1.30 | 3.84 |
| RT-690 Forged | 602 | -31.75 | 1.12 | 1.21 | 1.19 | 3.52 |
| RT-690 Forged | 601 | -39.37 | 0.99 | 1.07 | 1.06 | 3.12 |

## 8.5 Decay Heat

Table 18 provides the decay heat (in watts per capsule) for each of the 3 DPA BSU-8242 capsules after the end of the final irradiation cycle (166B), with additional time periods over the subsequent year. Calculations were made with the use of the ATR as-run data for lobe powers, irradiation periods, and outages, as summarized in Table 5.

Table 18. Decay Heating of the 3DPA Capsules Post Cycle 166B Irradiation.

| DECAY HEAT (Watts/Capsule) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| A6 300C 3 DPA | 72.01 | 26.27 | 23.65 | 12.19 | 6.26 | 4.41 | 3.78 | 3.22 | 2.21 |
| A7 400C 3 DPA Y | 109.00 | 34.72 | 30.90 | 14.09 | 5.53 | 3.32 | 2.58 | 1.91 | 0.68 |
| A8 400C 3 DPA X | 87.92 | 36.60 | 32.84 | 16.24 | 7.71 | 5.23 | 4.38 | 3.61 | 2.22 |

## 8.6 Radioactivity

The following six tables provide the total radionuclide activity in curies per capsule (Table 19-21) and mass per capsule (Table 22-24) detailed isotopically for each of the three DPA BSU-8242 capsules, which includes all material components, following the irradiation of Cycle 166B and carried out in eight additional increments over the subsequent year. Calculations were made with the implementation, within the ORIGEN input deck, of the ATR as-run lobe power data and irradiation times for Cycle 164B, 166A, and 166B. See Table 19 for the 'A6 300C 3 DPA' capsule source terms, Table 20 for the 'A7 400C 3 DPA X' capsule source terms, and Table 21 for the 'A8 400C 3 DPA Y' capsule source terms.

Table 19. Source Terms for 'A6 300C 3 DPA' Capsule.

| ACTIVATION PRODUCTS (Ci) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| H 3 | 8.72E-05 | 8.72E-05 | 8.72E-05 | 8.71E-05 | 8.68E-05 | 8.60E-05 | 8.55E-05 | 8.48E-05 | 8.25E-05 |
| H 4 | 2.79E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| HE 6 | 2.06E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| LI 8 | 1.05E-13 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BE 8 | 3.55E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BE 10 | 1.67E-09 | 1.67E-09 | 1.67E-09 | 1.67E-09 | 1.67E-09 | 1.67E-09 | 1.67E-09 | 1.67E-09 | 1.67E-09 |
| BE 11 | 1.14E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| B 12 | 4.86E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| C 14 | 6.13E-08 | 6.13E-08 | 6.13E-08 | 6.13E-08 | 6.13E-08 | 6.13E-08 | 6.13E-08 | 6.13E-08 | 6.13E-08 |
| C 15 | 1.61E-09 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| N 16 | 3.22E-15 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| O 19 | 1.15E-10 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| F 20 | 1.53E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NE 23 | 5.61E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NA 24 | 1.38E+01 | 4.56E+00 | 1.50E+00 | 2.11E-04 | 4.91E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NA 24M | 3.40E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NA 25 | 3.39E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MG 27 | 6.55E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MG 28 | 2.01E-07 | 9.08E-08 | 4.10E-08 | 7.06E-11 | 8.69E-18 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

| ACTIVATION PRODUCTS (Ci) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| AL 28 | 1.57E+03 | 9.10E-08 | 4.11E-08 | 7.07E-11 | 8.70E-18 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AL 29 | 3.23E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AL 30 | 3.12E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SI 31 | 3.39E-01 | 5.93E-04 | 1.04E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SI 32 | 1.05E-10 | 1.05E-10 | 1.05E-10 | 1.05E-10 | 1.05E-10 | 1.05E-10 | 1.05E-10 | 1.05E-10 | 1.05E-10 |
| P 32 | 2.41E-01 | 2.30E-01 | 2.19E-01 | 1.49E-01 | 5.64E-02 | 3.08E-03 | 4.43E-04 | 3.92E-05 | 6.48E-09 |
| P 33 | 1.26E-05 | 1.22E-05 | 1.19E-05 | 9.53E-06 | 5.47E-06 | 1.04E-06 | 3.42E-07 | 8.55E-08 | 5.82E-10 |
| P 34 | 7.81E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| S 35 | 5.25E-03 | 5.21E-03 | 5.17E-03 | 4.85E-03 | 4.15E-03 | 2.59E-03 | 1.89E-03 | 1.27E-03 | 3.08E-04 |
| S 37 | 2.26E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CL 36 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 | 1.72E-10 |
| CL 38 | 1.56E-08 | 3.51E-20 | 6.85E-32 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CL 38M | 1.86E-10 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AR 37 | 2.69E-13 | 2.64E-13 | 2.59E-13 | 2.21E-13 | 1.49E-13 | 4.53E-14 | 2.05E-14 | 7.63E-15 | 2.16E-16 |
| AR 39 | 3.12E-15 | 3.12E-15 | 3.12E-15 | 3.12E-15 | 3.12E-15 | 3.12E-15 | 3.11E-15 | 3.11E-15 | 3.11E-15 |
| AR 41 | 3.04E-09 | 3.38E-13 | 3.75E-17 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AR 42 | 6.84E-18 | 6.84E-18 | 6.84E-18 | 6.84E-18 | 6.83E-18 | 6.81E-18 | 6.79E-18 | 6.77E-18 | 6.70E-18 |
| K 42 | 3.14E-11 | 8.17E-12 | 2.13E-12 | 5.17E-17 | 6.83E-18 | 6.81E-18 | 6.79E-18 | 6.77E-18 | 6.70E-18 |
| K 43 | 3.86E-08 | 1.85E-08 | 8.84E-09 | 2.45E-11 | 9.90E-18 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| K 44 | 6.85E-09 | 1.35E-28 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CA 45 | 1.57E-04 | 1.57E-04 | 1.56E-04 | 1.51E-04 | 1.39E-04 | 1.07E-04 | 9.06E-05 | 7.32E-05 | 3.40E-05 |
| CA 47 | 2.98E-06 | 2.56E-06 | 2.20E-06 | 6.47E-07 | 3.04E-08 | 3.17E-12 | 7.03E-15 | 3.38E-18 | 3.83E-30 |
| SC 46 | 2.72E-02 | 2.70E-02 | 2.68E-02 | 2.50E-02 | 2.12E-02 | 1.29E-02 | 9.28E-03 | 6.14E-03 | 1.38E-03 |
| SC 46M | 2.13E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SC 47 | 7.05E-02 | 5.74E-02 | 4.66E-02 | 8.91E-03 | 1.42E-04 | 5.91E-10 | 1.78E-13 | 1.78E-17 | 1.47E-29 |
| SC 48 | 6.61E-03 | 4.52E-03 | 3.09E-03 | 1.48E-04 | 7.45E-08 | 9.48E-18 | 2.40E-24 | 2.28E-32 | 0.00E+00 |

| ACTIVATION PRODUCTS (Ci) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| SC 49 | 6.16E-03 | 1.78E-10 | 5.15E-18 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SC 50 | 1.13E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TI 51 | 1.44E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| V 50 | 1.12E-16 | 1.12E-16 | 1.12E-16 | 1.12E-16 | 1.12E-16 | 1.12E-16 | 1.12E-16 | 1.12E-16 | 1.12E-16 |
| V 52 | 3.18E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| V 53 | 1.22E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| V 54 | 1.33E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CR 51 | 2.23E+03 | 2.17E+03 | 2.12E+03 | 1.74E+03 | 1.05E+03 | 2.35E+02 | 8.63E+01 | 2.47E+01 | 2.74E-01 |
| CR 55 | 3.65E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MN 54 | 2.53E+01 | 2.52E+01 | 2.52E+01 | 2.48E+01 | 2.37E+01 | 2.07E+01 | 1.90E+01 | 1.70E+01 | 1.14E+01 |
| MN 56 | 7.70E+02 | 1.22E+00 | 1.92E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MN 57 | 2.37E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MN 58 | 7.08E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FE 55 | 1.15E+02 | 1.15E+02 | 1.15E+02 | 1.14E+02 | 1.13E+02 | 1.08E+02 | 1.05E+02 | 1.01E+02 | 8.84E+01 |
| FE 59 | 2.12E+01 | 2.08E+01 | 2.05E+01 | 1.81E+01 | 1.33E+01 | 5.29E+00 | 2.86E+00 | 1.32E+00 | 8.27E-02 |
| CO 58 | 2.11E+02 | 2.09E+02 | 2.07E+02 | 1.92E+02 | 1.57E+02 | 8.75E+01 | 5.91E+01 | 3.62E+01 | 6.21E+00 |
| CO 60 | 1.31E+02 | 1.31E+02 | 1.31E+02 | 1.31E+02 | 1.30E+02 | 1.27E+02 | 1.25E+02 | 1.23E+02 | 1.15E+02 |
| CO 60M | 1.13E+03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CO 61 | 8.98E+00 | 3.75E-04 | 1.57E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CO 62 | 6.85E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NI 59 | 7.71E-02 | 7.71E-02 | 7.71E-02 | 7.71E-02 | 7.71E-02 | 7.71E-02 | 7.71E-02 | 7.71E-02 | 7.71E-02 |
| NI 63 | 1.02E+01 | 1.02E+01 | 1.02E+01 | 1.02E+01 | 1.02E+01 | 1.02E+01 | 1.02E+01 | 1.02E+01 | 1.01E+01 |
| NI 65 | 8.04E+01 | 1.09E-01 | 1.48E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NI 66 | 2.40E-03 | 1.77E-03 | 1.31E-03 | 1.14E-04 | 2.58E-07 | 2.98E-15 | 1.52E-20 | 3.70E-27 | 0.00E+00 |
| CU 64 | 9.28E+01 | 2.50E+01 | 6.75E+00 | 1.90E-04 | 7.96E-16 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CU 66 | 2.04E+01 | 1.77E-03 | 1.31E-03 | 1.14E-04 | 2.59E-07 | 2.99E-15 | 1.53E-20 | 3.71E-27 | 0.00E+00 |

| ACTIVATION PRODUCTS (Ci) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| CU 67 | 1.14E-04 | 8.70E-05 | 6.65E-05 | 7.73E-06 | 3.57E-08 | 3.51E-15 | 7.48E-20 | 1.08E-25 | 0.00E+00 |
| ZN 65 | 1.09E-02 | 1.08E-02 | 1.08E-02 | 1.06E-02 | 9.98E-03 | 8.41E-03 | 7.51E-03 | 6.51E-03 | 3.91E-03 |
| ZN 69 | 2.11E-07 | 4.55E-09 | 1.36E-09 | 8.58E-14 | 2.71E-24 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| ZN 69M | 1.42E-08 | 4.24E-09 | 1.27E-09 | 7.99E-14 | 2.53E-24 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| GA 70 | 4.37E-10 | 1.26E-30 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| GA 72 | 9.03E-16 | 2.92E-16 | 9.43E-17 | 7.51E-21 | 4.34E-31 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| GE 71 | 3.11E-13 | 2.93E-13 | 2.77E-13 | 1.73E-13 | 5.34E-14 | 1.57E-15 | 1.51E-16 | 8.41E-18 | 2.15E-22 |
| GE 71M | 3.83E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SR 89 | 1.57E-07 | 1.55E-07 | 1.53E-07 | 1.37E-07 | 1.04E-07 | 4.58E-08 | 2.64E-08 | 1.33E-08 | 1.13E-09 |
| SR 90 | 1.99E-10 | 1.99E-10 | 1.99E-10 | 1.99E-10 | 1.98E-10 | 1.98E-10 | 1.97E-10 | 1.97E-10 | 1.94E-10 |
| SR 91 | 4.79E-09 | 8.31E-10 | 1.44E-10 | 1.19E-16 | 6.85E-32 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SR 93 | 8.84E-15 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 89M | 2.53E-03 | 2.04E-03 | 1.65E-03 | 3.03E-04 | 4.36E-06 | 1.30E-11 | 2.69E-15 | 6.67E-20 | 0.00E+00 |
| Y 90 | 1.19E-02 | 9.17E-03 | 7.07E-03 | 8.84E-04 | 4.88E-06 | 1.99E-10 | 1.97E-10 | 1.97E-10 | 1.94E-10 |
| Y 90M | 3.91E-09 | 1.83E-11 | 8.54E-14 | 2.28E-32 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 91 | 1.15E-06 | 1.14E-06 | 1.13E-06 | 1.03E-06 | 8.09E-07 | 3.97E-07 | 2.47E-07 | 1.37E-07 | 1.62E-08 |
| Y 92 | 6.06E-07 | 5.50E-09 | 5.00E-11 | 2.33E-27 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 93 | 8.84E-15 | 1.71E-15 | 3.39E-16 | 6.43E-22 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 94 | 3.41E-09 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 96 | 1.18E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| ZR 89 | 2.53E-03 | 2.05E-03 | 1.66E-03 | 3.03E-04 | 4.36E-06 | 1.30E-11 | 2.69E-15 | 6.68E-20 | 0.00E+00 |
| ZR 93 | 3.12E-08 | 3.12E-08 | 3.12E-08 | 3.12E-08 | 3.12E-08 | 3.12E-08 | 3.12E-08 | 3.12E-08 | 3.12E-08 |
| ZR 95 | 5.85E-03 | 5.78E-03 | 5.72E-03 | 5.25E-03 | 4.22E-03 | 2.21E-03 | 1.43E-03 | 8.32E-04 | 1.18E-04 |
| ZR 97 | 2.00E-04 | 7.47E-05 | 2.79E-05 | 1.06E-08 | 2.99E-17 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 92 | 4.96E-01 | 4.64E-01 | 4.33E-01 | 2.51E-01 | 6.41E-02 | 1.07E-03 | 6.98E-05 | 2.30E-06 | 1.07E-11 |
| NB 93M | 7.07E-10 | 7.11E-10 | 7.15E-10 | 7.47E-10 | 8.28E-10 | 1.07E-09 | 1.23E-09 | 1.43E-09 | 2.13E-09 |

| ACTIVATION PRODUCTS (Ci) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| NB 94 | 4.29E-03 | 4.29E-03 | 4.29E-03 | 4.29E-03 | 4.29E-03 | 4.29E-03 | 4.29E-03 | 4.29E-03 | 4.29E-03 |
| NB 95 | 1.15E+01 | 1.13E+01 | 1.11E+01 | 9.47E+00 | 6.38E+00 | 1.96E+00 | 8.90E-01 | 3.33E-01 | 9.78E-03 |
| NB 95M | 4.16E-05 | 4.14E-05 | 4.12E-05 | 3.87E-05 | 3.13E-05 | 1.64E-05 | 1.06E-05 | 6.17E-06 | 8.78E-07 |
| NB 96 | 6.23E-02 | 3.05E-02 | 1.50E-02 | 5.01E-05 | 3.25E-11 | 8.85E-30 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 97 | 7.11E-03 | 7.50E-05 | 2.80E-05 | 1.14E-08 | 3.22E-17 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 97M | 1.89E-04 | 7.07E-05 | 2.64E-05 | 1.01E-08 | 2.83E-17 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 98 | 1.06E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB100 | 5.25E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MO 93M | 1.46E-01 | 1.29E-02 | 1.14E-03 | 4.15E-12 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MO 93 | 4.40E-04 | 4.40E-04 | 4.40E-04 | 4.40E-04 | 4.40E-04 | 4.40E-04 | 4.40E-04 | 4.40E-04 | 4.40E-04 |
| MO 99 | 1.02E+02 | 7.95E+01 | 6.18E+01 | 8.23E+00 | 5.32E-02 | 1.44E-08 | 6.02E-13 | 2.02E-18 | 0.00E+00 |
| MO101 | 2.54E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TC 99 | 1.86E-05 | 1.87E-05 | 1.88E-05 | 1.90E-05 | 1.91E-05 | 1.91E-05 | 1.91E-05 | 1.91E-05 | 1.91E-05 |
| TC100 | 1.68E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TC101 | 2.54E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RU103 | 1.29E-03 | 1.27E-03 | 1.24E-03 | 1.08E-03 | 7.59E-04 | 2.63E-04 | 1.30E-04 | 5.38E-05 | 2.25E-06 |
| RU105 | 1.80E-08 | 4.25E-10 | 1.00E-11 | 9.54E-25 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RU106 | 7.99E-15 | 7.98E-15 | 7.96E-15 | 7.85E-15 | 7.56E-15 | 6.75E-15 | 6.26E-15 | 5.70E-15 | 4.06E-15 |
| RH104 | 2.20E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH104M | 1.59E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH105 | 1.41E-08 | 1.04E-08 | 6.50E-09 | 1.51E-10 | 1.24E-14 | 6.82E-27 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH105M | 5.05E-09 | 1.19E-10 | 2.81E-12 | 2.68E-25 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH106 | 2.69E-09 | 7.98E-15 | 7.96E-15 | 7.85E-15 | 7.56E-15 | 6.75E-15 | 6.26E-15 | 5.70E-15 | 4.06E-15 |
| RH106M | 1.30E-09 | 6.78E-13 | 3.53E-16 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| PD107M | 1.05E-13 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| PD109 | 5.10E-16 | 1.58E-16 | 3.38E-17 | 1.72E-21 | 2.28E-32 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

| ACTIVATION PRODUCTS (Ci) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| AG109M | 5.10E-16 | 1.58E-16 | 4.60E-17 | 1.72E-21 | 2.28E-32 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TM172 | 1.92E-09 | 1.48E-09 | 1.14E-09 | 1.40E-10 | 7.50E-13 | 1.15E-19 | 3.28E-24 | 6.85E-30 | 0.00E+00 |
| TM173 | 1.71E-09 | 2.27E-10 | 3.02E-11 | 2.92E-18 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| YB175 | 2.90E-12 | 2.46E-12 | 2.09E-12 | 5.55E-13 | 2.03E-14 | 9.92E-19 | 1.09E-18 | 2.79E-22 | 0.00E+00 |
| YB175M | 2.05E-12 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| LU176 | 6.68E-15 | 6.68E-15 | 6.68E-15 | 6.68E-15 | 6.68E-15 | 6.68E-15 | 6.68E-15 | 6.68E-15 | 6.68E-15 |
| LU176M | 5.69E-03 | 6.26E-05 | 6.90E-07 | 1.50E-22 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| LU177 | 1.74E-03 | 1.57E-03 | 1.41E-03 | 6.18E-04 | 7.86E-05 | 3.98E-07 | 2.02E-07 | 1.60E-07 | 7.14E-08 |
| LU177M | 1.55E-06 | 1.55E-06 | 1.54E-06 | 1.48E-06 | 1.36E-06 | 1.04E-06 | 8.68E-07 | 6.94E-07 | 3.10E-07 |
| HF175 | 2.02E-02 | 2.00E-02 | 1.98E-02 | 1.83E-02 | 1.50E-02 | 8.30E-03 | 5.58E-03 | 3.40E-03 | 5.72E-04 |
| HF178M | 4.99E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| HF179M | 5.49E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| HF180M | 3.26E-02 | 1.59E-03 | 7.70E-05 | 2.39E-15 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| HF181 | 4.64E-01 | 4.56E-01 | 4.49E-01 | 3.94E-01 | 2.84E-01 | 1.07E-01 | 5.54E-02 | 2.45E-02 | 1.29E-03 |
| HF182 | 1.93E-10 | 1.93E-10 | 1.93E-10 | 1.93E-10 | 1.93E-10 | 1.93E-10 | 1.93E-10 | 1.93E-10 | 1.93E-10 |
| TA180 | 1.32E-14 | 1.32E-14 | 1.32E-14 | 1.32E-14 | 1.32E-14 | 1.32E-14 | 1.32E-14 | 1.32E-14 | 1.32E-14 |
| TA182 | 3.33E+02 | 3.31E+02 | 3.29E+02 | 3.13E+02 | 2.78E+02 | 1.93E+02 | 1.52E+02 | 1.12E+02 | 3.80E+01 |
| TA182M | 1.76E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TA183 | 3.39E+03 | 2.96E+03 | 2.59E+03 | 8.72E+02 | 5.75E+01 | 1.65E-02 | 7.20E-05 | 8.05E-08 | 1.91E-18 |
| W181 | 2.02E-15 | 2.01E-15 | 2.00E-15 | 1.91E-15 | 1.70E-15 | 1.21E-15 | 9.62E-16 | 7.23E-16 | 2.58E-16 |
| W183M | 4.08E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| W185 | 6.62E-01 | 6.56E-01 | 6.50E-01 | 6.04E-01 | 5.02E-01 | 2.89E-01 | 2.00E-01 | 1.26E-01 | 2.39E-02 |
| W185M | 2.06E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| W187 | 4.82E-04 | 2.40E-04 | 1.20E-04 | 4.58E-07 | 4.12E-13 | 2.97E-31 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| W188 | 1.18E-06 | 1.17E-06 | 1.16E-06 | 1.07E-06 | 8.76E-07 | 4.81E-07 | 3.23E-07 | 1.96E-07 | 3.25E-08 |
| RE186 | 1.37E-01 | 1.14E-01 | 9.48E-02 | 2.18E-02 | 5.56E-04 | 9.17E-09 | 5.95E-12 | 6.15E-16 | 2.76E-30 |

| ACTIVATION PRODUCTS (Ci) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| RE187 | 6.26E-16 | 6.39E-16 | 6.46E-16 | 6.52E-16 | 6.52E-16 | 6.52E-16 | 6.52E-16 | 6.52E-16 | 6.52E-16 |
| RE188 | 2.06E-05 | 8.60E-06 | 3.96E-06 | 1.08E-06 | 8.85E-07 | 4.86E-07 | 3.26E-07 | 1.98E-07 | 3.28E-08 |
| RE188M | 1.90E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE189 | 3.41E-10 | 1.72E-10 | 8.67E-11 | 3.62E-13 | 4.10E-19 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| OS190M | 9.17E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| OS191 | 1.34E-11 | 1.33E-11 | 1.28E-11 | 8.97E-12 | 3.65E-12 | 2.45E-13 | 4.06E-14 | 4.28E-15 | 1.30E-18 |
| OS191M | 1.98E-11 | 5.50E-12 | 1.53E-12 | 5.47E-17 | 4.20E-28 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| IR192 | 3.42E-13 | 3.39E-13 | 3.36E-13 | 3.11E-13 | 2.58E-13 | 1.47E-13 | 1.01E-13 | 6.34E-14 | 1.18E-14 |
| IR194 | 1.71E-14 | 7.18E-15 | 3.01E-15 | 2.89E-18 | 8.22E-26 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| IR194M | 9.03E-16 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| PT193M | 2.25E-16 | 1.89E-16 | 1.58E-16 | 4.27E-17 | 6.01E-19 | 3.79E-23 | 3.79E-23 | 1.20E-26 | 0.00E+00 |
| TOTAL | 1.05E+04 | 6.10E+03 | 5.63E+03 | 3.43E+03 | 1.84E+03 | 7.89E+02 | 5.60E+02 | 4.26E+02 | 2.70E+02 |

Table 20. Source Terms for 'A7 400C 3 DPA Y' Capsule.

| ACTIVATION PRODUCTS (Ci) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| H 3 | 1.03E-04 | 1.03E-04 | 1.03E-04 | 1.03E-04 | 1.03E-04 | 1.02E-04 | 1.01E-04 | 1.00E-04 | 9.76E-05 |
| H 4 | 3.37E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| HE 6 | 1.61E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| LI 8 | 3.19E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BE 8 | 2.77E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BE 10 | 1.42E-09 | 1.42E-09 | 1.42E-09 | 1.42E-09 | 1.42E-09 | 1.42E-09 | 1.42E-09 | 1.42E-09 | 1.42E-09 |
| BE 11 | 8.89E-09 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| B 12 | 6.65E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| C 14 | 3.28E-03 | 3.28E-03 | 3.28E-03 | 3.28E-03 | 3.28E-03 | 3.28E-03 | 3.28E-03 | 3.28E-03 | 3.28E-03 |
| C 15 | 7.59E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| N 16 | 2.53E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| O 19 | 1.05E-10 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| F 20 | 1.52E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NE 23 | 6.09E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NA 24 | 1.50E+01 | 4.94E+00 | 1.63E+00 | 2.28E-04 | 5.31E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NA 24M | 3.37E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NA 25 | 3.68E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MG 27 | 7.09E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MG 28 | 1.99E-07 | 8.98E-08 | 4.05E-08 | 6.98E-11 | 8.59E-18 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AL 28 | 1.69E+03 | 9.00E-08 | 4.06E-08 | 7.00E-11 | 8.61E-18 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AL 29 | 4.27E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AL 30 | 4.12E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SI 31 | 6.49E-01 | 1.14E-03 | 2.00E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SI 32 | 1.84E-10 | 1.84E-10 | 1.84E-10 | 1.84E-10 | 1.84E-10 | 1.84E-10 | 1.84E-10 | 1.84E-10 | 1.84E-10 |
| P 32 | 7.48E-01 | 7.13E-01 | 6.79E-01 | 4.61E-01 | 1.75E-01 | 9.53E-03 | 1.37E-03 | 1.22E-04 | 1.99E-08 |

| ACTIVATION PRODUCTS (Ci) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| P 33 | 2.38E-05 | 2.31E-05 | 2.25E-05 | 1.80E-05 | 1.04E-05 | 1.96E-06 | 6.47E-07 | 1.62E-07 | 1.10E-09 |
| P 34 | 1.49E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| S 35 | 1.00E-02 | 9.92E-03 | 9.84E-03 | 9.24E-03 | 7.90E-03 | 4.92E-03 | 3.59E-03 | 2.42E-03 | 5.87E-04 |
| S 37 | 4.29E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CL 36 | 2.99E-10 | 2.99E-10 | 2.99E-10 | 2.99E-10 | 2.99E-10 | 2.99E-10 | 2.99E-10 | 2.99E-10 | 2.99E-10 |
| CL 38 | 2.70E-08 | 6.08E-20 | 1.37E-31 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CL 38M | 3.21E-10 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AR 37 | 4.28E-13 | 4.20E-13 | 4.12E-13 | 3.51E-13 | 2.37E-13 | 7.21E-14 | 3.27E-14 | 1.22E-14 | 3.45E-16 |
| AR 39 | 5.03E-15 | 5.03E-15 | 5.03E-15 | 5.03E-15 | 5.03E-15 | 5.03E-15 | 5.03E-15 | 5.03E-15 | 5.02E-15 |
| AR 41 | 5.81E-13 | 6.45E-17 | 7.16E-21 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| K 42 | 4.87E-16 | 1.41E-16 | 2.17E-17 | 4.58E-22 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| K 44 | 1.33E-12 | 2.28E-32 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CA 45 | 1.05E-09 | 1.05E-09 | 1.04E-09 | 1.01E-09 | 9.27E-10 | 7.18E-10 | 6.06E-10 | 4.90E-10 | 2.28E-10 |
| CA 47 | 6.95E-09 | 5.96E-09 | 5.12E-09 | 1.51E-09 | 7.09E-11 | 7.39E-15 | 1.54E-17 | 7.37E-21 | 0.00E+00 |
| SC 46 | 3.46E-12 | 3.44E-12 | 3.41E-12 | 3.19E-12 | 2.70E-12 | 1.65E-12 | 1.18E-12 | 7.82E-13 | 1.76E-13 |
| SC 46M | 4.37E-12 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SC 47 | 2.97E-05 | 2.42E-05 | 1.97E-05 | 3.76E-06 | 6.02E-08 | 2.72E-13 | 1.32E-16 | 3.06E-20 | 0.00E+00 |
| SC 48 | 6.75E-05 | 4.62E-05 | 3.16E-05 | 1.51E-06 | 7.61E-10 | 9.68E-20 | 2.45E-26 | 0.00E+00 | 0.00E+00 |
| SC 49 | 8.13E-06 | 2.35E-13 | 6.80E-21 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SC 50 | 6.95E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TI 51 | 1.57E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| V 50 | 1.44E-16 | 1.44E-16 | 1.44E-16 | 1.44E-16 | 1.44E-16 | 1.44E-16 | 1.44E-16 | 1.44E-16 | 1.44E-16 |
| V 52 | 4.27E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| V 53 | 1.04E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| V 54 | 1.13E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CR 51 | 1.92E+03 | 1.87E+03 | 1.82E+03 | 1.49E+03 | 9.04E+02 | 2.02E+02 | 7.41E+01 | 2.12E+01 | 2.35E-01 |

| ACTIVATION PRODUCTS (Ci) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| CR 55 | 3.14E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MN 54 | 4.60E+01 | 4.59E+01 | 4.58E+01 | 4.50E+01 | 4.31E+01 | 3.77E+01 | 3.45E+01 | 3.09E+01 | 2.07E+01 |
| MN 56 | 2.51E+03 | 3.97E+00 | 6.24E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MN 57 | 4.24E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MN 58 | 1.26E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FE 55 | 1.99E+02 | 1.99E+02 | 1.99E+02 | 1.98E+02 | 1.95E+02 | 1.87E+02 | 1.81E+02 | 1.75E+02 | 1.53E+02 |
| FE 59 | 3.78E+01 | 3.72E+01 | 3.66E+01 | 3.24E+01 | 2.38E+01 | 9.44E+00 | 5.10E+00 | 2.36E+00 | 1.48E-01 |
| CO 58 | 7.03E+01 | 6.97E+01 | 6.90E+01 | 6.38E+01 | 5.24E+01 | 2.91E+01 | 1.97E+01 | 1.21E+01 | 2.07E+00 |
| CO 60 | 5.09E-01 | 5.08E-01 | 5.08E-01 | 5.07E-01 | 5.03E-01 | 4.92E-01 | 4.85E-01 | 4.77E-01 | 4.47E-01 |
| CO 60M | 6.30E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CO 61 | 1.50E-01 | 6.29E-06 | 2.63E-10 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CO 62 | 2.19E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NI 59 | 2.44E-02 | 2.44E-02 | 2.44E-02 | 2.44E-02 | 2.44E-02 | 2.44E-02 | 2.44E-02 | 2.44E-02 | 2.44E-02 |
| NI 63 | 3.21E+00 | 3.21E+00 | 3.21E+00 | 3.21E+00 | 3.21E+00 | 3.20E+00 | 3.20E+00 | 3.20E+00 | 3.18E+00 |
| NI 65 | 2.52E+01 | 3.43E-02 | 4.65E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NI 66 | 6.88E-04 | 5.08E-04 | 3.74E-04 | 3.27E-05 | 7.40E-08 | 8.54E-16 | 4.36E-21 | 1.06E-27 | 0.00E+00 |
| CU 64 | 3.88E+01 | 1.05E+01 | 2.83E+00 | 7.95E-05 | 3.33E-16 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CU 66 | 8.48E+00 | 5.08E-04 | 3.75E-04 | 3.28E-05 | 7.41E-08 | 8.55E-16 | 4.37E-21 | 1.06E-27 | 0.00E+00 |
| CU 67 | 4.33E-05 | 3.31E-05 | 2.53E-05 | 2.94E-06 | 1.36E-08 | 1.34E-15 | 2.84E-20 | 4.12E-26 | 0.00E+00 |
| ZN 65 | 4.16E-03 | 4.15E-03 | 4.13E-03 | 4.04E-03 | 3.82E-03 | 3.22E-03 | 2.87E-03 | 2.49E-03 | 1.49E-03 |
| ZN 69 | 6.75E-08 | 1.45E-09 | 4.34E-10 | 2.74E-14 | 8.66E-25 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| ZN 69M | 4.54E-09 | 1.35E-09 | 4.04E-10 | 2.55E-14 | 8.06E-25 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| GA 70 | 1.28E-10 | 3.65E-31 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| GA 72 | 2.20E-16 | 5.34E-17 | 2.76E-17 | 2.19E-21 | 1.14E-31 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| GE 71 | 8.30E-14 | 7.83E-14 | 7.38E-14 | 4.61E-14 | 1.43E-14 | 4.20E-16 | 3.95E-17 | 1.69E-18 | 4.32E-23 |
| GE 71M | 1.02E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

| ACTIVATION PRODUCTS (Ci) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| SR 89 | 4.05E-08 | 3.99E-08 | 3.94E-08 | 3.53E-08 | 2.68E-08 | 1.18E-08 | 6.80E-09 | 3.42E-09 | 2.89E-10 |
| SR 90 | 1.15E-11 | 1.15E-11 | 1.15E-11 | 1.15E-11 | 1.15E-11 | 1.15E-11 | 1.14E-11 | 1.14E-11 | 1.13E-11 |
| SR 91 | 1.21E-09 | 2.10E-10 | 3.64E-11 | 3.00E-17 | 2.28E-32 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SR 93 | 2.08E-15 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 89M | 7.10E-04 | 5.74E-04 | 4.64E-04 | 8.51E-05 | 1.23E-06 | 3.65E-12 | 7.55E-16 | 1.88E-20 | 0.00E+00 |
| Y 90 | 1.06E-04 | 8.16E-05 | 6.29E-05 | 7.86E-06 | 4.34E-08 | 1.15E-11 | 1.14E-11 | 1.14E-11 | 1.13E-11 |
| Y 90M | 1.01E-09 | 4.70E-12 | 2.19E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 91 | 1.56E-08 | 1.54E-08 | 1.52E-08 | 1.39E-08 | 1.09E-08 | 5.37E-09 | 3.34E-09 | 1.85E-09 | 2.19E-10 |
| Y 92 | 1.55E-07 | 1.41E-09 | 1.28E-11 | 5.97E-28 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 93 | 2.08E-15 | 4.16E-16 | 7.09E-17 | 1.34E-22 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 94 | 8.63E-10 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 96 | 2.76E-15 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| ZR 89 | 7.11E-04 | 5.75E-04 | 4.65E-04 | 8.53E-05 | 1.23E-06 | 3.65E-12 | 7.56E-16 | 1.88E-20 | 0.00E+00 |
| ZR 93 | 1.99E-09 | 1.99E-09 | 1.99E-09 | 1.99E-09 | 1.99E-09 | 1.99E-09 | 1.99E-09 | 1.99E-09 | 1.99E-09 |
| ZR 95 | 1.64E-03 | 1.63E-03 | 1.61E-03 | 1.48E-03 | 1.19E-03 | 6.20E-04 | 4.02E-04 | 2.34E-04 | 3.33E-05 |
| ZR 97 | 5.62E-05 | 2.10E-05 | 7.84E-06 | 2.98E-09 | 8.40E-18 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 92 | 1.40E-01 | 1.30E-01 | 1.22E-01 | 7.05E-02 | 1.80E-02 | 3.01E-04 | 1.96E-05 | 6.48E-07 | 3.01E-12 |
| NB 93M | 4.46E-11 | 4.48E-11 | 4.51E-11 | 4.71E-11 | 5.23E-11 | 6.76E-11 | 7.78E-11 | 9.04E-11 | 1.35E-10 |
| NB 94 | 3.80E-05 | 3.80E-05 | 3.80E-05 | 3.80E-05 | 3.80E-05 | 3.80E-05 | 3.80E-05 | 3.80E-05 | 3.80E-05 |
| NB 95 | 9.69E-02 | 9.50E-02 | 9.32E-02 | 7.98E-02 | 5.42E-02 | 1.72E-02 | 8.07E-03 | 3.20E-03 | 1.51E-04 |
| NB 95M | 1.17E-05 | 1.17E-05 | 1.16E-05 | 1.09E-05 | 8.81E-06 | 4.60E-06 | 2.98E-06 | 1.74E-06 | 2.47E-07 |
| NB 96 | 5.46E-03 | 2.68E-03 | 1.31E-03 | 4.40E-06 | 2.85E-12 | 7.76E-31 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 97 | 2.00E-03 | 2.11E-05 | 7.88E-06 | 3.21E-09 | 9.06E-18 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 97M | 5.32E-05 | 1.99E-05 | 7.43E-06 | 2.82E-09 | 7.96E-18 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 98 | 2.97E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB100 | 1.48E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

| ACTIVATION PRODUCTS (Ci) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| MO 93M | 4.11E-02 | 3.62E-03 | 3.19E-04 | 1.17E-12 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MO 93 | 1.24E-04 | 1.24E-04 | 1.24E-04 | 1.24E-04 | 1.24E-04 | 1.24E-04 | 1.24E-04 | 1.24E-04 | 1.24E-04 |
| MO 99 | 2.88E+01 | 2.24E+01 | 1.74E+01 | 2.31E+00 | 1.50E-02 | 4.05E-09 | 1.69E-13 | 5.69E-19 | 0.00E+00 |
| MO101 | 7.15E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TC 99 | 5.27E-06 | 5.30E-06 | 5.32E-06 | 5.38E-06 | 5.39E-06 | 5.39E-06 | 5.39E-06 | 5.39E-06 | 5.39E-06 |
| TC100 | 4.35E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TC101 | 7.15E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RU103 | 3.03E-04 | 2.98E-04 | 2.93E-04 | 2.54E-04 | 1.79E-04 | 6.19E-05 | 3.06E-05 | 1.27E-05 | 5.28E-07 |
| RU105 | 3.54E-09 | 8.34E-11 | 1.97E-12 | 1.88E-25 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RU106 | 1.44E-15 | 1.43E-15 | 1.43E-15 | 1.41E-15 | 1.36E-15 | 1.21E-15 | 1.12E-15 | 1.02E-15 | 7.29E-16 |
| RH104 | 4.79E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH104M | 3.47E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH105 | 2.82E-09 | 2.07E-09 | 1.30E-09 | 3.01E-11 | 2.47E-15 | 1.36E-27 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH105M | 9.91E-10 | 2.34E-11 | 5.52E-13 | 5.26E-26 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH106 | 4.91E-10 | 1.43E-15 | 1.43E-15 | 1.41E-15 | 1.36E-15 | 1.21E-15 | 1.12E-15 | 1.02E-15 | 7.29E-16 |
| RH106M | 2.39E-10 | 1.24E-13 | 6.45E-17 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| PD107M | 1.75E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TM172 | 1.66E-09 | 1.28E-09 | 9.84E-10 | 1.21E-10 | 6.49E-13 | 9.92E-20 | 2.84E-24 | 5.93E-30 | 0.00E+00 |
| TM173 | 1.42E-09 | 1.89E-10 | 2.51E-11 | 2.43E-18 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| YB175 | 1.96E-12 | 1.66E-12 | 1.41E-12 | 3.74E-13 | 1.37E-14 | 6.69E-19 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| YB175M | 1.38E-12 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| LU176 | 6.07E-15 | 6.07E-15 | 6.07E-15 | 6.07E-15 | 6.07E-15 | 6.07E-15 | 6.07E-15 | 6.07E-15 | 6.07E-15 |
| LU176M | 4.92E-03 | 5.42E-05 | 5.97E-07 | 1.30E-22 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| LU177 | 1.44E-03 | 1.30E-03 | 1.17E-03 | 5.12E-04 | 6.50E-05 | 3.26E-07 | 1.65E-07 | 1.30E-07 | 5.82E-08 |
| LU177M | 1.27E-06 | 1.26E-06 | 1.26E-06 | 1.21E-06 | 1.11E-06 | 8.47E-07 | 7.08E-07 | 5.66E-07 | 2.53E-07 |
| HF175 | 1.93E-02 | 1.91E-02 | 1.89E-02 | 1.75E-02 | 1.43E-02 | 7.91E-03 | 5.32E-03 | 3.24E-03 | 5.46E-04 |

| ACTIVATION PRODUCTS (Ci) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| HF178M | 5.53E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| HF179M | 5.33E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| HF180M | 2.89E-02 | 1.41E-03 | 6.83E-05 | 2.12E-15 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| HF181 | 4.19E-01 | 4.12E-01 | 4.06E-01 | 3.56E-01 | 2.57E-01 | 9.62E-02 | 5.00E-02 | 2.21E-02 | 1.16E-03 |
| HF182 | 1.60E-10 | 1.60E-10 | 1.60E-10 | 1.60E-10 | 1.60E-10 | 1.60E-10 | 1.60E-10 | 1.60E-10 | 1.60E-10 |
| TA180 | 2.35E-14 | 2.35E-14 | 2.35E-14 | 2.35E-14 | 2.35E-14 | 2.35E-14 | 2.35E-14 | 2.35E-14 | 2.35E-14 |
| TA182 | 5.46E+02 | 5.43E+02 | 5.39E+02 | 5.14E+02 | 4.56E+02 | 3.17E+02 | 2.49E+02 | 1.84E+02 | 6.23E+01 |
| TA182M | 2.67E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TA183 | 5.10E+03 | 4.45E+03 | 3.89E+03 | 1.31E+03 | 8.65E+01 | 2.49E-02 | 1.08E-04 | 1.20E-07 | 2.86E-18 |
| W181 | 3.09E-15 | 3.08E-15 | 3.06E-15 | 2.92E-15 | 2.61E-15 | 1.85E-15 | 1.47E-15 | 1.11E-15 | 3.95E-16 |
| W183M | 6.04E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| W185 | 7.97E-01 | 7.90E-01 | 7.83E-01 | 7.27E-01 | 6.05E-01 | 3.48E-01 | 2.40E-01 | 1.51E-01 | 2.88E-02 |
| W185M | 2.50E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| W187 | 4.87E-04 | 2.43E-04 | 1.21E-04 | 4.62E-07 | 4.16E-13 | 2.97E-31 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| W188 | 1.09E-06 | 1.08E-06 | 1.06E-06 | 9.82E-07 | 8.04E-07 | 4.42E-07 | 2.96E-07 | 1.80E-07 | 2.98E-08 |
| RE186 | 1.52E-01 | 1.26E-01 | 1.05E-01 | 2.42E-02 | 6.17E-04 | 1.02E-08 | 6.60E-12 | 6.82E-16 | 3.06E-30 |
| RE187 | 6.30E-16 | 6.43E-16 | 6.49E-16 | 6.56E-16 | 6.56E-16 | 6.56E-16 | 6.56E-16 | 6.56E-16 | 6.56E-16 |
| RE188 | 1.89E-05 | 7.91E-06 | 3.64E-06 | 9.94E-07 | 8.13E-07 | 4.46E-07 | 2.99E-07 | 1.82E-07 | 3.01E-08 |
| RE188M | 1.75E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE189 | 2.86E-10 | 1.44E-10 | 7.28E-11 | 3.05E-13 | 3.45E-19 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| OS190M | 6.99E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| OS191 | 9.25E-12 | 9.19E-12 | 8.88E-12 | 6.22E-12 | 2.53E-12 | 1.70E-13 | 2.81E-14 | 2.96E-15 | 9.00E-19 |
| OS191M | 1.37E-11 | 3.82E-12 | 1.06E-12 | 3.80E-17 | 2.92E-28 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| IR192 | 2.21E-13 | 2.19E-13 | 2.17E-13 | 2.02E-13 | 1.67E-13 | 9.53E-14 | 6.55E-14 | 4.10E-14 | 7.60E-15 |
| IR194 | 9.27E-15 | 3.89E-15 | 1.64E-15 | 1.58E-18 | 4.49E-26 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| IR194M | 4.89E-16 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

| ACTIVATION PRODUCTS (Ci) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| PT193M | 1.33E-16 | 1.11E-16 | 9.33E-17 | 2.80E-17 | 3.29E-18 | 2.08E-22 | 2.08E-22 | 6.56E-26 | 0.00E+00 |
| SUMTOT | 1.24E+04 | 7.26E+03 | 6.63E+03 | 3.66E+03 | 1.77E+03 | 7.86E+02 | 5.68E+02 | 4.30E+02 | 2.43E+02 |
| 0TOTAL | 1.24E+04 | 7.26E+03 | 6.63E+03 | 3.66E+03 | 1.77E+03 | 7.86E+02 | 5.68E+02 | 4.30E+02 | 2.43E+02 |

Table 21. Source Terms for 'A8 400C 3 DPA X' Capsule.

| ACTIVATION PRODUCTS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| H 3 | 1.04E-04 | 1.04E-04 | 1.04E-04 | 1.03E-04 | 1.03E-04 | 1.02E-04 | 1.02E-04 | 1.01E-04 | 9.80E-05 |
| H 4 | 3.07E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| HE 6 | 2.11E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| LI 8 | 2.09E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BE 8 | 3.63E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BE 10 | 1.85E-09 | 1.85E-09 | 1.85E-09 | 1.85E-09 | 1.85E-09 | 1.85E-09 | 1.85E-09 | 1.85E-09 | 1.85E-09 |
| BE 11 | 1.17E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| B 12 | 4.36E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| C 14 | 2.14E-04 | 2.14E-04 | 2.14E-04 | 2.14E-04 | 2.14E-04 | 2.14E-04 | 2.14E-04 | 2.14E-04 | 2.14E-04 |
| C 15 | 5.10E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| N 16 | 1.65E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| O 19 | 1.07E-10 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| F 20 | 1.54E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NE 23 | 6.14E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NA 24 | 1.51E+01 | 4.99E+00 | 1.64E+00 | 2.31E-04 | 5.37E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NA 24M | 3.42E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NA 25 | 3.71E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MG 27 | 7.16E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MG 28 | 2.03E-07 | 9.14E-08 | 4.13E-08 | 7.11E-11 | 8.75E-18 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

| ACTIVATION PRODUCTS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| AL 28 | 1.71E+03 | 9.16E-08 | 4.13E-08 | 7.12E-11 | 8.77E-18 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AL 29 | 3.50E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AL 30 | 3.38E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SI 31 | 3.84E-01 | 6.74E-04 | 1.18E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SI 32 | 1.09E-10 | 1.09E-10 | 1.09E-10 | 1.09E-10 | 1.09E-10 | 1.09E-10 | 1.09E-10 | 1.09E-10 | 1.09E-10 |
| P 32 | 2.86E-01 | 2.72E-01 | 2.59E-01 | 1.76E-01 | 6.67E-02 | 3.64E-03 | 5.24E-04 | 4.64E-05 | 7.65E-09 |
| P 33 | 1.33E-05 | 1.29E-05 | 1.26E-05 | 1.01E-05 | 5.79E-06 | 1.10E-06 | 3.62E-07 | 9.04E-08 | 6.15E-10 |
| P 34 | 8.31E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| S 35 | 5.59E-03 | 5.54E-03 | 5.50E-03 | 5.16E-03 | 4.41E-03 | 2.75E-03 | 2.01E-03 | 1.35E-03 | 3.28E-04 |
| S 37 | 2.40E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CL 36 | 1.68E-10 | 1.68E-10 | 1.68E-10 | 1.68E-10 | 1.68E-10 | 1.68E-10 | 1.68E-10 | 1.68E-10 | 1.68E-10 |
| CL 38 | 1.52E-08 | 3.42E-20 | 6.85E-32 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CL 38M | 1.81E-10 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AR 37 | 2.43E-13 | 2.38E-13 | 2.33E-13 | 1.99E-13 | 1.34E-13 | 4.09E-14 | 1.85E-14 | 6.88E-15 | 1.95E-16 |
| AR 39 | 2.85E-15 | 2.85E-15 | 2.85E-15 | 2.85E-15 | 2.85E-15 | 2.85E-15 | 2.85E-15 | 2.85E-15 | 2.84E-15 |
| AR 41 | 2.47E-09 | 2.74E-13 | 3.04E-17 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AR 42 | 5.11E-18 | 5.11E-18 | 5.11E-18 | 5.10E-18 | 5.10E-18 | 5.08E-18 | 5.07E-18 | 5.05E-18 | 5.00E-18 |
| K 42 | 2.52E-11 | 6.57E-12 | 1.71E-12 | 4.12E-17 | 5.10E-18 | 5.08E-18 | 5.07E-18 | 5.05E-18 | 5.00E-18 |
| K 43 | 3.13E-08 | 1.50E-08 | 7.18E-09 | 1.99E-11 | 8.03E-18 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| K 44 | 5.56E-09 | 1.10E-28 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CA 45 | 1.38E-04 | 1.38E-04 | 1.37E-04 | 1.33E-04 | 1.22E-04 | 9.44E-05 | 7.96E-05 | 6.43E-05 | 2.99E-05 |
| CA 47 | 2.47E-06 | 2.12E-06 | 1.82E-06 | 5.37E-07 | 2.53E-08 | 2.63E-12 | 5.84E-15 | 2.81E-18 | 3.17E-30 |
| SC 46 | 2.40E-02 | 2.38E-02 | 2.36E-02 | 2.21E-02 | 1.87E-02 | 1.14E-02 | 8.18E-03 | 5.41E-03 | 1.22E-03 |
| SC 46M | 1.73E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SC 47 | 6.22E-02 | 5.06E-02 | 4.11E-02 | 7.86E-03 | 1.26E-04 | 5.21E-10 | 1.55E-13 | 1.50E-17 | 1.21E-29 |
| SC 48 | 5.87E-03 | 4.02E-03 | 2.75E-03 | 1.32E-04 | 6.62E-08 | 8.42E-18 | 2.13E-24 | 2.28E-32 | 0.00E+00 |

| ACTIVATION PRODUCTS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| SC 49 | 5.38E-03 | 1.55E-10 | 4.50E-18 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SC 50 | 9.96E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TI 51 | 1.31E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| V 50 | 1.63E-16 | 1.63E-16 | 1.63E-16 | 1.63E-16 | 1.63E-16 | 1.63E-16 | 1.63E-16 | 1.63E-16 | 1.63E-16 |
| V 52 | 4.80E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| V 53 | 1.24E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| V 54 | 1.35E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CR 51 | 2.28E+03 | 2.23E+03 | 2.17E+03 | 1.78E+03 | 1.08E+03 | 2.40E+02 | 8.83E+01 | 2.53E+01 | 2.80E-01 |
| CR 55 | 3.70E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MN 54 | 3.17E+01 | 3.16E+01 | 3.15E+01 | 3.10E+01 | 2.96E+01 | 2.59E+01 | 2.37E+01 | 2.12E+01 | 1.42E+01 |
| MN 56 | 8.69E+02 | 1.37E+00 | 2.16E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MN 57 | 2.92E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MN 58 | 8.78E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FE 55 | 1.42E+02 | 1.42E+02 | 1.42E+02 | 1.41E+02 | 1.39E+02 | 1.33E+02 | 1.29E+02 | 1.24E+02 | 1.09E+02 |
| FE 59 | 2.63E+01 | 2.59E+01 | 2.55E+01 | 2.25E+01 | 1.66E+01 | 6.57E+00 | 3.55E+00 | 1.64E+00 | 1.03E-01 |
| CO 58 | 2.10E+02 | 2.08E+02 | 2.06E+02 | 1.91E+02 | 1.57E+02 | 8.70E+01 | 5.88E+01 | 3.60E+01 | 6.18E+00 |
| CO 60 | 1.16E+02 | 1.16E+02 | 1.16E+02 | 1.16E+02 | 1.15E+02 | 1.12E+02 | 1.11E+02 | 1.09E+02 | 1.02E+02 |
| CO 60M | 9.98E+02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CO 61 | 7.35E+00 | 3.08E-04 | 1.29E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CO 62 | 6.49E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NI 59 | 7.31E-02 | 7.31E-02 | 7.31E-02 | 7.31E-02 | 7.31E-02 | 7.31E-02 | 7.31E-02 | 7.31E-02 | 7.31E-02 |
| NI 63 | 9.62E+00 | 9.62E+00 | 9.62E+00 | 9.62E+00 | 9.61E+00 | 9.60E+00 | 9.59E+00 | 9.58E+00 | 9.55E+00 |
| NI 65 | 7.57E+01 | 1.03E-01 | 1.39E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NI 66 | 2.08E-03 | 1.53E-03 | 1.13E-03 | 9.89E-05 | 2.23E-07 | 2.58E-15 | 1.32E-20 | 3.20E-27 | 0.00E+00 |
| CU 64 | 9.39E+01 | 2.53E+01 | 6.84E+00 | 1.92E-04 | 8.06E-16 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CU 66 | 2.06E+01 | 1.54E-03 | 1.13E-03 | 9.90E-05 | 2.24E-07 | 2.58E-15 | 1.32E-20 | 3.20E-27 | 0.00E+00 |

| ACTIVATION PRODUCTS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| CU 67 | 1.06E-04 | 8.09E-05 | 6.18E-05 | 7.19E-06 | 3.32E-08 | 3.26E-15 | 6.95E-20 | 1.01E-25 | 0.00E+00 |
| ZN 65 | 1.01E-02 | 1.01E-02 | 1.01E-02 | 9.84E-03 | 9.29E-03 | 7.84E-03 | 7.00E-03 | 6.07E-03 | 3.64E-03 |
| ZN 69 | 1.67E-07 | 3.59E-09 | 1.07E-09 | 6.77E-14 | 2.14E-24 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| ZN 69M | 1.12E-08 | 3.35E-09 | 9.99E-10 | 6.30E-14 | 1.99E-24 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| GA 70 | 3.17E-10 | 9.13E-31 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| GA 72 | 5.56E-16 | 1.80E-16 | 4.35E-17 | 3.47E-21 | 2.05E-31 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| GE 71 | 2.08E-13 | 1.96E-13 | 1.85E-13 | 1.16E-13 | 3.57E-14 | 1.05E-15 | 1.01E-16 | 5.62E-18 | 1.44E-22 |
| GE 71M | 2.56E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SR 89 | 1.34E-07 | 1.32E-07 | 1.31E-07 | 1.17E-07 | 8.88E-08 | 3.90E-08 | 2.25E-08 | 1.13E-08 | 9.58E-10 |
| SR 90 | 1.64E-10 | 1.64E-10 | 1.64E-10 | 1.64E-10 | 1.64E-10 | 1.63E-10 | 1.63E-10 | 1.62E-10 | 1.60E-10 |
| SR 91 | 4.06E-09 | 7.05E-10 | 1.22E-10 | 1.01E-16 | 6.85E-32 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SR 93 | 6.93E-15 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 89M | 2.34E-03 | 1.89E-03 | 1.53E-03 | 2.80E-04 | 4.03E-06 | 1.20E-11 | 2.49E-15 | 6.17E-20 | 0.00E+00 |
| Y 90 | 1.06E-02 | 8.17E-03 | 6.30E-03 | 7.88E-04 | 4.35E-06 | 1.64E-10 | 1.63E-10 | 1.62E-10 | 1.61E-10 |
| Y 90M | 3.33E-09 | 1.56E-11 | 7.27E-14 | 2.28E-32 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 91 | 9.48E-07 | 9.37E-07 | 9.26E-07 | 8.42E-07 | 6.64E-07 | 3.26E-07 | 2.03E-07 | 1.12E-07 | 1.33E-08 |
| Y 92 | 5.16E-07 | 4.69E-09 | 4.26E-11 | 1.98E-27 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 93 | 6.93E-15 | 1.34E-15 | 2.66E-16 | 5.04E-22 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 94 | 2.89E-09 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 96 | 9.22E-15 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| ZR 89 | 2.34E-03 | 1.89E-03 | 1.53E-03 | 2.81E-04 | 4.04E-06 | 1.20E-11 | 2.49E-15 | 6.18E-20 | 0.00E+00 |
| ZR 93 | 2.80E-08 | 2.80E-08 | 2.80E-08 | 2.80E-08 | 2.80E-08 | 2.80E-08 | 2.80E-08 | 2.80E-08 | 2.80E-08 |
| ZR 95 | 5.41E-03 | 5.35E-03 | 5.29E-03 | 4.85E-03 | 3.91E-03 | 2.04E-03 | 1.32E-03 | 7.69E-04 | 1.09E-04 |
| ZR 97 | 1.85E-04 | 6.90E-05 | 2.58E-05 | 9.81E-09 | 2.77E-17 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 92 | 4.59E-01 | 4.29E-01 | 4.00E-01 | 2.32E-01 | 5.93E-02 | 9.89E-04 | 6.46E-05 | 2.13E-06 | 9.89E-12 |
| NB 93M | 6.34E-10 | 6.38E-10 | 6.41E-10 | 6.70E-10 | 7.43E-10 | 9.58E-10 | 1.10E-09 | 1.28E-09 | 1.91E-09 |

| ACTIVATION PRODUCTS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| NB 94 | 3.84E-03 | 3.84E-03 | 3.84E-03 | 3.84E-03 | 3.84E-03 | 3.84E-03 | 3.84E-03 | 3.84E-03 | 3.84E-03 |
| NB 95 | 9.48E+00 | 9.30E+00 | 9.12E+00 | 7.79E+00 | 5.25E+00 | 1.61E+00 | 7.33E-01 | 2.74E-01 | 8.07E-03 |
| NB 95M | 3.85E-05 | 3.83E-05 | 3.81E-05 | 3.57E-05 | 2.90E-05 | 1.51E-05 | 9.81E-06 | 5.71E-06 | 8.12E-07 |
| NB 96 | 5.01E-02 | 2.46E-02 | 1.21E-02 | 4.03E-05 | 2.62E-11 | 7.12E-30 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 97 | 6.57E-03 | 6.94E-05 | 2.59E-05 | 1.06E-08 | 2.98E-17 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 97M | 1.75E-04 | 6.54E-05 | 2.44E-05 | 9.29E-09 | 2.62E-17 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 98 | 9.78E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB100 | 4.85E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MO 93M | 1.35E-01 | 1.19E-02 | 1.05E-03 | 3.84E-12 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MO 93 | 4.07E-04 | 4.07E-04 | 4.07E-04 | 4.07E-04 | 4.07E-04 | 4.07E-04 | 4.07E-04 | 4.07E-04 | 4.07E-04 |
| MO 99 | 9.46E+01 | 7.35E+01 | 5.72E+01 | 7.61E+00 | 4.92E-02 | 1.33E-08 | 5.57E-13 | 1.87E-18 | 0.00E+00 |
| MO101 | 2.35E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TC 99 | 1.73E-05 | 1.74E-05 | 1.75E-05 | 1.77E-05 | 1.77E-05 | 1.77E-05 | 1.77E-05 | 1.77E-05 | 1.77E-05 |
| TC100 | 1.44E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TC101 | 2.35E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RU103 | 1.01E-03 | 9.93E-04 | 9.76E-04 | 8.47E-04 | 5.95E-04 | 2.07E-04 | 1.02E-04 | 4.22E-05 | 1.76E-06 |
| RU105 | 1.20E-08 | 2.82E-10 | 6.65E-12 | 6.34E-25 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RU106 | 4.89E-15 | 4.88E-15 | 4.87E-15 | 4.80E-15 | 4.62E-15 | 4.13E-15 | 3.83E-15 | 3.48E-15 | 2.48E-15 |
| RH104 | 1.61E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH104M | 1.16E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH105 | 9.53E-09 | 6.98E-09 | 4.39E-09 | 1.02E-10 | 8.35E-15 | 4.60E-27 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH105M | 3.35E-09 | 7.93E-11 | 1.87E-12 | 1.78E-25 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH106 | 1.67E-09 | 4.88E-15 | 4.87E-15 | 4.80E-15 | 4.62E-15 | 4.13E-15 | 3.83E-15 | 3.48E-15 | 2.48E-15 |
| RH106M | 8.12E-10 | 4.22E-13 | 2.20E-16 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| PD107M | 6.01E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| PD109 | 2.48E-16 | 7.68E-17 | 1.64E-17 | 8.33E-22 | 2.28E-32 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

| ACTIVATION PRODUCTS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| AG109M | 2.47E-16 | 7.69E-17 | 2.23E-17 | 8.33E-22 | 2.28E-32 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TA180 | 2.27E-14 | 2.27E-14 | 2.27E-14 | 2.27E-14 | 2.27E-14 | 2.27E-14 | 2.27E-14 | 2.27E-14 | 2.27E-14 |
| TA182 | 5.29E+02 | 5.25E+02 | 5.22E+02 | 4.98E+02 | 4.41E+02 | 3.07E+02 | 2.41E+02 | 1.79E+02 | 6.04E+01 |
| TA182M | 2.60E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TA183 | 4.98E+03 | 4.34E+03 | 3.79E+03 | 1.28E+03 | 8.44E+01 | 2.43E-02 | 1.06E-04 | 1.18E-07 | 2.79E-18 |
| W181 | 3.01E-15 | 3.00E-15 | 2.98E-15 | 2.85E-15 | 2.54E-15 | 1.80E-15 | 1.43E-15 | 1.08E-15 | 3.84E-16 |
| W183M | 5.90E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| W185 | 7.91E-01 | 7.84E-01 | 7.77E-01 | 7.22E-01 | 6.00E-01 | 3.45E-01 | 2.38E-01 | 1.50E-01 | 2.85E-02 |
| W185M | 2.48E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| W187 | 4.90E-04 | 2.44E-04 | 1.22E-04 | 4.65E-07 | 4.18E-13 | 2.97E-31 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| W188 | 1.10E-06 | 1.09E-06 | 1.08E-06 | 9.96E-07 | 8.16E-07 | 4.48E-07 | 3.00E-07 | 1.82E-07 | 3.02E-08 |
| RE186 | 1.52E-01 | 1.26E-01 | 1.05E-01 | 2.42E-02 | 6.16E-04 | 1.02E-08 | 6.59E-12 | 6.82E-16 | 3.06E-30 |
| RE187 | 6.34E-16 | 6.47E-16 | 6.54E-16 | 6.60E-16 | 6.60E-16 | 6.60E-16 | 6.60E-16 | 6.60E-16 | 6.60E-16 |
| RE188 | 1.92E-05 | 8.02E-06 | 3.69E-06 | 1.01E-06 | 8.24E-07 | 4.53E-07 | 3.04E-07 | 1.84E-07 | 3.05E-08 |
| RE188M | 1.77E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE189 | 2.92E-10 | 1.48E-10 | 7.44E-11 | 3.11E-13 | 3.52E-19 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| OS190M | 7.20E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| OS191 | 9.59E-12 | 9.52E-12 | 9.20E-12 | 6.45E-12 | 2.62E-12 | 1.76E-13 | 2.91E-14 | 3.07E-15 | 9.33E-19 |
| OS191M | 1.42E-11 | 3.96E-12 | 1.10E-12 | 3.94E-17 | 3.02E-28 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| IR192 | 2.31E-13 | 2.29E-13 | 2.26E-13 | 2.10E-13 | 1.74E-13 | 9.93E-14 | 6.83E-14 | 4.27E-14 | 7.92E-15 |
| IR194 | 9.80E-15 | 4.11E-15 | 1.72E-15 | 1.65E-18 | 4.70E-26 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| IR194M | 5.17E-16 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| PT193M | 1.39E-16 | 1.17E-16 | 9.79E-17 | 2.94E-17 | 4.13E-19 | 2.60E-23 | 2.60E-23 | 8.22E-27 | 0.00E+00 |
| SUMTOT | 1.24E+04 | 7.75E+03 | 7.09E+03 | 4.08E+03 | 2.08E+03 | 9.24E+02 | 6.66E+02 | 5.06E+02 | 3.02E+02 |
| 0TOTAL | 1.24E+04 | 7.75E+03 | 7.09E+03 | 4.08E+03 | 2.08E+03 | 9.24E+02 | 6.66E+02 | 5.06E+02 | 3.02E+02 |

Table 22. Source Terms for 'A6 300C 3 DPA' Capsule.

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| H 1 | 1.12E-03 | 1.12E-03 | 1.12E-03 | 1.12E-03 | 1.12E-03 | 1.12E-03 | 1.12E-03 | 1.12E-03 | 1.12E-03 |
| H 2 | 6.17E-07 | 6.17E-07 | 6.17E-07 | 6.17E-07 | 6.17E-07 | 6.17E-07 | 6.17E-07 | 6.17E-07 | 6.17E-07 |
| H 3 | 9.03E-09 | 9.03E-09 | 9.03E-09 | 9.02E-09 | 8.99E-09 | 8.91E-09 | 8.86E-09 | 8.79E-09 | 8.55E-09 |
| HE 3 | 3.32E-11 | 3.46E-11 | 3.60E-11 | 4.71E-11 | 7.47E-11 | 1.57E-10 | 2.12E-10 | 2.80E-10 | 5.19E-10 |
| HE 4 | 1.14E-02 | 1.14E-02 | 1.14E-02 | 1.14E-02 | 1.14E-02 | 1.14E-02 | 1.14E-02 | 1.14E-02 | 1.14E-02 |
| HE 6 | 8.85E-17 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| LI 6 | 2.55E-10 | 2.55E-10 | 2.55E-10 | 2.55E-10 | 2.55E-10 | 2.55E-10 | 2.55E-10 | 2.55E-10 | 2.55E-10 |
| LI 7 | 1.40E-14 | 1.40E-14 | 1.40E-14 | 1.40E-14 | 1.40E-14 | 1.40E-14 | 1.40E-14 | 1.40E-14 | 1.40E-14 |
| BE 9 | 2.92E-06 | 2.92E-06 | 2.92E-06 | 2.92E-06 | 2.92E-06 | 2.92E-06 | 2.92E-06 | 2.92E-06 | 2.92E-06 |
| BE 10 | 7.47E-08 | 7.47E-08 | 7.47E-08 | 7.47E-08 | 7.47E-08 | 7.47E-08 | 7.47E-08 | 7.47E-08 | 7.47E-08 |
| B 10 | 2.41E-15 | 2.50E-15 | 2.59E-15 | 3.29E-15 | 5.07E-15 | 1.04E-14 | 1.39E-14 | 1.84E-14 | 3.43E-14 |
| B 11 | 6.01E-14 | 6.01E-14 | 6.01E-14 | 6.01E-14 | 6.01E-14 | 6.01E-14 | 6.01E-14 | 6.01E-14 | 6.01E-14 |
| C 12 | 6.30E-01 | 6.30E-01 | 6.30E-01 | 6.30E-01 | 6.30E-01 | 6.30E-01 | 6.30E-01 | 6.30E-01 | 6.30E-01 |
| C 13 | 7.67E-03 | 7.67E-03 | 7.67E-03 | 7.67E-03 | 7.67E-03 | 7.67E-03 | 7.67E-03 | 7.67E-03 | 7.67E-03 |
| C 14 | 1.37E-08 | 1.37E-08 | 1.37E-08 | 1.37E-08 | 1.37E-08 | 1.37E-08 | 1.37E-08 | 1.37E-08 | 1.37E-08 |
| N 14 | 7.90E-13 | 7.95E-13 | 8.00E-13 | 8.36E-13 | 9.27E-13 | 1.20E-12 | 1.38E-12 | 1.61E-12 | 2.43E-12 |
| N 15 | 7.75E-15 | 7.75E-15 | 7.75E-15 | 7.75E-15 | 7.75E-15 | 7.75E-15 | 7.75E-15 | 7.75E-15 | 7.75E-15 |
| O 17 | 4.05E-17 | 4.05E-17 | 4.05E-17 | 4.05E-17 | 4.05E-17 | 4.05E-17 | 4.05E-17 | 4.05E-17 | 4.05E-17 |
| O 18 | 3.80E-09 | 3.80E-09 | 3.80E-09 | 3.80E-09 | 3.80E-09 | 3.80E-09 | 3.80E-09 | 3.80E-09 | 3.80E-09 |
| F 19 | 6.97E-16 | 6.97E-16 | 6.97E-16 | 6.97E-16 | 6.97E-16 | 6.97E-16 | 6.97E-16 | 6.97E-16 | 6.97E-16 |
| NE 20 | 1.47E-12 | 1.47E-12 | 1.47E-12 | 1.47E-12 | 1.47E-12 | 1.47E-12 | 1.47E-12 | 1.47E-12 | 1.47E-12 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| NE 21 | 4.04E-06 | 4.04E-06 | 4.04E-06 | 4.04E-06 | 4.04E-06 | 4.04E-06 | 4.04E-06 | 4.04E-06 | 4.04E-06 |
| NE 22 | 6.07E-06 | 6.07E-06 | 6.07E-06 | 6.07E-06 | 6.07E-06 | 6.07E-06 | 6.07E-06 | 6.07E-06 | 6.07E-06 |
| NE 23 | 4.26E-12 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NA 23 | 1.23E-06 | 1.23E-06 | 1.23E-06 | 1.23E-06 | 1.23E-06 | 1.23E-06 | 1.23E-06 | 1.23E-06 | 1.23E-06 |
| NA 24 | 1.59E-06 | 5.24E-07 | 1.73E-07 | 2.42E-11 | 5.64E-21 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NA 25 | 4.47E-12 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MG 24 | 6.32E-01 | 6.32E-01 | 6.32E-01 | 6.32E-01 | 6.32E-01 | 6.32E-01 | 6.32E-01 | 6.32E-01 | 6.32E-01 |
| MG 25 | 8.34E-02 | 8.34E-02 | 8.34E-02 | 8.34E-02 | 8.34E-02 | 8.34E-02 | 8.34E-02 | 8.34E-02 | 8.34E-02 |
| MG 26 | 9.55E-02 | 9.55E-02 | 9.55E-02 | 9.55E-02 | 9.55E-02 | 9.55E-02 | 9.55E-02 | 9.55E-02 | 9.55E-02 |
| MG 27 | 8.89E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MG 28 | 3.76E-14 | 1.70E-14 | 7.65E-15 | 1.32E-17 | 1.62E-24 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AL 27 | 1.12E+02 | 1.12E+02 | 1.12E+02 | 1.12E+02 | 1.12E+02 | 1.12E+02 | 1.12E+02 | 1.12E+02 | 1.12E+02 |
| AL 28 | 5.22E-07 | 3.03E-17 | 1.37E-17 | 2.36E-20 | 2.90E-27 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AL 29 | 3.24E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AL 30 | 3.05E-16 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SI 28 | 1.33E+00 | 1.33E+00 | 1.33E+00 | 1.33E+00 | 1.33E+00 | 1.33E+00 | 1.33E+00 | 1.33E+00 | 1.33E+00 |
| SI 29 | 6.80E-02 | 6.80E-02 | 6.80E-02 | 6.80E-02 | 6.80E-02 | 6.80E-02 | 6.80E-02 | 6.80E-02 | 6.80E-02 |
| SI 30 | 4.65E-02 | 4.65E-02 | 4.65E-02 | 4.65E-02 | 4.65E-02 | 4.65E-02 | 4.65E-02 | 4.65E-02 | 4.65E-02 |
| SI 31 | 8.78E-09 | 1.54E-11 | 2.69E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SI 32 | 6.10E-12 | 6.10E-12 | 6.10E-12 | 6.10E-12 | 6.10E-12 | 6.09E-12 | 6.09E-12 | 6.09E-12 | 6.09E-12 |
| P 31 | 9.49E-03 | 9.49E-03 | 9.49E-03 | 9.49E-03 | 9.49E-03 | 9.49E-03 | 9.49E-03 | 9.49E-03 | 9.49E-03 |
| P 32 | 8.45E-07 | 8.05E-07 | 7.67E-07 | 5.21E-07 | 1.98E-07 | 1.08E-08 | 1.55E-09 | 1.37E-10 | 2.27E-14 |
| P 33 | 7.94E-11 | 7.72E-11 | 7.51E-11 | 6.02E-11 | 3.46E-11 | 6.55E-12 | 2.16E-12 | 5.40E-13 | 3.67E-15 |
| P 34 | 2.92E-15 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| S 32 | 1.76E-02 | 1.76E-02 | 1.76E-02 | 1.76E-02 | 1.76E-02 | 1.76E-02 | 1.76E-02 | 1.76E-02 | 1.76E-02 |
| S 33 | 1.57E-04 | 1.57E-04 | 1.57E-04 | 1.57E-04 | 1.57E-04 | 1.57E-04 | 1.57E-04 | 1.57E-04 | 1.57E-04 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| S 34 | 8.29E-04 | 8.29E-04 | 8.29E-04 | 8.29E-04 | 8.29E-04 | 8.29E-04 | 8.29E-04 | 8.29E-04 | 8.29E-04 |
| S 35 | 1.24E-07 | 1.23E-07 | 1.22E-07 | 1.15E-07 | 9.78E-08 | 6.10E-08 | 4.45E-08 | 3.00E-08 | 7.27E-09 |
| S 36 | 3.54E-06 | 3.54E-06 | 3.54E-06 | 3.54E-06 | 3.54E-06 | 3.54E-06 | 3.54E-06 | 3.54E-06 | 3.54E-06 |
| S 37 | 2.25E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CL 35 | 1.70E-07 | 1.71E-07 | 1.72E-07 | 1.80E-07 | 1.96E-07 | 2.33E-07 | 2.50E-07 | 2.64E-07 | 2.87E-07 |
| CL 36 | 5.20E-09 | 5.20E-09 | 5.20E-09 | 5.20E-09 | 5.20E-09 | 5.20E-09 | 5.20E-09 | 5.20E-09 | 5.20E-09 |
| CL 37 | 8.22E-10 | 8.22E-10 | 8.22E-10 | 8.22E-10 | 8.22E-10 | 8.22E-10 | 8.22E-10 | 8.22E-10 | 8.22E-10 |
| CL 38 | 1.17E-16 | 2.64E-28 | 5.94E-40 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AR 36 | 2.36E-15 | 2.39E-15 | 2.43E-15 | 2.68E-15 | 3.33E-15 | 5.26E-15 | 6.54E-15 | 8.15E-15 | 1.39E-14 |
| AR 38 | 2.79E-13 | 2.79E-13 | 2.79E-13 | 2.79E-13 | 2.79E-13 | 2.79E-13 | 2.79E-13 | 2.79E-13 | 2.79E-13 |
| AR 39 | 9.14E-17 | 9.14E-17 | 9.14E-17 | 9.14E-17 | 9.14E-17 | 9.14E-17 | 9.13E-17 | 9.13E-17 | 9.12E-17 |
| AR 40 | 1.83E-12 | 1.83E-12 | 1.83E-12 | 1.83E-12 | 1.83E-12 | 1.83E-12 | 1.83E-12 | 1.83E-12 | 1.83E-12 |
| AR 41 | 7.27E-17 | 8.08E-21 | 8.97E-25 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| K 41 | 5.93E-14 | 5.94E-14 | 5.94E-14 | 5.94E-14 | 5.94E-14 | 5.94E-14 | 5.94E-14 | 5.94E-14 | 5.94E-14 |
| K 43 | 1.20E-14 | 5.72E-15 | 2.74E-15 | 7.60E-18 | 3.07E-24 | 1.81E-43 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| K 44 | 3.52E-17 | 6.97E-37 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CA 42 | 5.74E-16 | 5.78E-16 | 5.79E-16 | 5.79E-16 | 5.79E-16 | 5.79E-16 | 5.79E-16 | 5.79E-16 | 5.79E-16 |
| CA 43 | 9.59E-08 | 9.59E-08 | 9.59E-08 | 9.59E-08 | 9.59E-08 | 9.59E-08 | 9.59E-08 | 9.59E-08 | 9.59E-08 |
| CA 44 | 7.40E-07 | 7.40E-07 | 7.40E-07 | 7.40E-07 | 7.40E-07 | 7.40E-07 | 7.40E-07 | 7.40E-07 | 7.40E-07 |
| CA 45 | 8.84E-09 | 8.80E-09 | 8.76E-09 | 8.47E-09 | 7.78E-09 | 6.03E-09 | 5.08E-09 | 4.11E-09 | 1.91E-09 |
| CA 46 | 8.88E-08 | 8.88E-08 | 8.88E-08 | 8.88E-08 | 8.88E-08 | 8.88E-08 | 8.88E-08 | 8.88E-08 | 8.88E-08 |
| CA 47 | 4.86E-12 | 4.17E-12 | 3.58E-12 | 1.06E-12 | 4.97E-14 | 5.18E-18 | 1.15E-20 | 5.51E-24 | 6.24E-36 |
| SC 45 | 6.59E-09 | 6.63E-09 | 6.66E-09 | 6.96E-09 | 7.65E-09 | 9.40E-09 | 1.03E-08 | 1.13E-08 | 1.35E-08 |
| SC 46 | 8.02E-07 | 7.96E-07 | 7.89E-07 | 7.39E-07 | 6.26E-07 | 3.81E-07 | 2.74E-07 | 1.81E-07 | 4.08E-08 |
| SC 46M | 1.62E-16 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SC 47 | 8.50E-08 | 6.91E-08 | 5.62E-08 | 1.08E-08 | 1.72E-10 | 7.13E-16 | 2.14E-19 | 2.14E-23 | 1.77E-35 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| SC 48 | 4.43E-09 | 3.03E-09 | 2.07E-09 | 9.94E-11 | 5.00E-14 | 6.36E-24 | 1.61E-30 | 9.12E-39 | 0.00E+00 |
| SC 49 | 9.23E-11 | 2.67E-18 | 7.72E-26 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SC 50 | 5.13E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TI 46 | 3.20E-02 | 3.20E-02 | 3.20E-02 | 3.20E-02 | 3.20E-02 | 3.20E-02 | 3.20E-02 | 3.20E-02 | 3.20E-02 |
| TI 47 | 2.95E-02 | 2.95E-02 | 2.95E-02 | 2.95E-02 | 2.95E-02 | 2.95E-02 | 2.95E-02 | 2.95E-02 | 2.95E-02 |
| TI 48 | 2.95E-01 | 2.95E-01 | 2.95E-01 | 2.95E-01 | 2.95E-01 | 2.95E-01 | 2.95E-01 | 2.95E-01 | 2.95E-01 |
| TI 49 | 2.58E-02 | 2.58E-02 | 2.58E-02 | 2.58E-02 | 2.58E-02 | 2.58E-02 | 2.58E-02 | 2.58E-02 | 2.58E-02 |
| TI 50 | 2.22E-02 | 2.22E-02 | 2.22E-02 | 2.22E-02 | 2.22E-02 | 2.22E-02 | 2.22E-02 | 2.22E-02 | 2.22E-02 |
| TI 51 | 2.26E-10 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| V 50 | 6.24E-04 | 6.24E-04 | 6.24E-04 | 6.24E-04 | 6.24E-04 | 6.24E-04 | 6.24E-04 | 6.24E-04 | 6.24E-04 |
| V 51 | 1.04E-01 | 1.04E-01 | 1.05E-01 | 1.09E-01 | 1.16E-01 | 1.25E-01 | 1.27E-01 | 1.28E-01 | 1.28E-01 |
| V 52 | 3.30E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| V 53 | 5.53E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| V 54 | 3.50E-13 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CR 50 | 5.30E+00 | 5.30E+00 | 5.30E+00 | 5.30E+00 | 5.30E+00 | 5.30E+00 | 5.30E+00 | 5.30E+00 | 5.30E+00 |
| CR 51 | 2.41E-02 | 2.35E-02 | 2.29E-02 | 1.88E-02 | 1.14E-02 | 2.54E-03 | 9.33E-04 | 2.67E-04 | 2.96E-06 |
| CR 52 | 1.08E+02 | 1.08E+02 | 1.08E+02 | 1.08E+02 | 1.08E+02 | 1.08E+02 | 1.08E+02 | 1.08E+02 | 1.08E+02 |
| CR 53 | 1.28E+01 | 1.28E+01 | 1.28E+01 | 1.28E+01 | 1.28E+01 | 1.28E+01 | 1.28E+01 | 1.28E+01 | 1.28E+01 |
| CR 54 | 3.52E+00 | 3.52E+00 | 3.52E+00 | 3.52E+00 | 3.52E+00 | 3.52E+00 | 3.52E+00 | 3.52E+00 | 3.52E+00 |
| CR 55 | 3.79E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MN 54 | 3.27E-03 | 3.26E-03 | 3.25E-03 | 3.20E-03 | 3.06E-03 | 2.68E-03 | 2.45E-03 | 2.19E-03 | 1.47E-03 |
| MN 55 | 1.35E+00 | 1.35E+00 | 1.35E+00 | 1.35E+00 | 1.35E+00 | 1.36E+00 | 1.36E+00 | 1.36E+00 | 1.36E+00 |
| MN 56 | 3.54E-05 | 5.60E-08 | 8.84E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MN 57 | 1.15E-10 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MN 58 | 2.37E-13 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FE 54 | 1.43E+01 | 1.43E+01 | 1.43E+01 | 1.43E+01 | 1.43E+01 | 1.43E+01 | 1.43E+01 | 1.43E+01 | 1.43E+01 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| FE 55 | 4.60E-02 | 4.59E-02 | 4.59E-02 | 4.56E-02 | 4.50E-02 | 4.31E-02 | 4.18E-02 | 4.03E-02 | 3.54E-02 |
| FE 56 | 2.34E+02 | 2.34E+02 | 2.34E+02 | 2.34E+02 | 2.34E+02 | 2.34E+02 | 2.34E+02 | 2.34E+02 | 2.34E+02 |
| FE 57 | 6.60E+00 | 6.60E+00 | 6.60E+00 | 6.60E+00 | 6.60E+00 | 6.60E+00 | 6.60E+00 | 6.60E+00 | 6.60E+00 |
| FE 58 | 8.06E-01 | 8.06E-01 | 8.06E-01 | 8.07E-01 | 8.08E-01 | 8.10E-01 | 8.11E-01 | 8.12E-01 | 8.13E-01 |
| FE 59 | 4.30E-04 | 4.24E-04 | 4.17E-04 | 3.69E-04 | 2.71E-04 | 1.08E-04 | 5.81E-05 | 2.69E-05 | 1.68E-06 |
| CO 58 | 6.64E-03 | 6.57E-03 | 6.51E-03 | 6.02E-03 | 4.95E-03 | 2.75E-03 | 1.86E-03 | 1.14E-03 | 1.95E-04 |
| CO 59 | 1.53E+00 | 1.53E+00 | 1.53E+00 | 1.53E+00 | 1.53E+00 | 1.53E+00 | 1.53E+00 | 1.53E+00 | 1.53E+00 |
| CO 60 | 1.16E-01 | 1.16E-01 | 1.16E-01 | 1.15E-01 | 1.15E-01 | 1.12E-01 | 1.11E-01 | 1.09E-01 | 1.02E-01 |
| CO 60M | 3.76E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CO 61 | 2.88E-07 | 1.21E-11 | 5.04E-16 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CO 62 | 3.39E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NI 58 | 1.42E+02 | 1.42E+02 | 1.42E+02 | 1.42E+02 | 1.42E+02 | 1.42E+02 | 1.42E+02 | 1.42E+02 | 1.42E+02 |
| NI 59 | 1.02E+00 | 1.02E+00 | 1.02E+00 | 1.02E+00 | 1.02E+00 | 1.02E+00 | 1.02E+00 | 1.02E+00 | 1.02E+00 |
| NI 60 | 5.63E+01 | 5.63E+01 | 5.63E+01 | 5.63E+01 | 5.63E+01 | 5.63E+01 | 5.63E+01 | 5.63E+01 | 5.63E+01 |
| NI 61 | 2.71E+00 | 2.71E+00 | 2.71E+00 | 2.71E+00 | 2.71E+00 | 2.71E+00 | 2.71E+00 | 2.71E+00 | 2.71E+00 |
| NI 62 | 7.86E+00 | 7.86E+00 | 7.86E+00 | 7.86E+00 | 7.86E+00 | 7.86E+00 | 7.86E+00 | 7.86E+00 | 7.86E+00 |
| NI 63 | 1.65E-01 | 1.65E-01 | 1.65E-01 | 1.65E-01 | 1.65E-01 | 1.65E-01 | 1.65E-01 | 1.65E-01 | 1.64E-01 |
| NI 64 | 2.10E+00 | 2.10E+00 | 2.10E+00 | 2.10E+00 | 2.10E+00 | 2.10E+00 | 2.10E+00 | 2.10E+00 | 2.10E+00 |
| NI 65 | 4.20E-06 | 5.70E-09 | 7.74E-12 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NI 66 | 2.76E-09 | 2.04E-09 | 1.50E-09 | 1.31E-10 | 2.97E-13 | 3.43E-21 | 1.75E-26 | 4.25E-33 | 0.00E+00 |
| CU 63 | 7.26E-01 | 7.26E-01 | 7.26E-01 | 7.26E-01 | 7.26E-01 | 7.26E-01 | 7.26E-01 | 7.27E-01 | 7.27E-01 |
| CU 64 | 2.41E-05 | 6.49E-06 | 1.75E-06 | 4.92E-11 | 2.06E-22 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CU 65 | 3.39E-01 | 3.39E-01 | 3.39E-01 | 3.39E-01 | 3.39E-01 | 3.39E-01 | 3.39E-01 | 3.39E-01 | 3.39E-01 |
| CU 66 | 3.64E-08 | 3.17E-12 | 2.34E-12 | 2.05E-13 | 4.63E-16 | 5.34E-24 | 2.73E-29 | 6.63E-36 | 0.00E+00 |
| CU 67 | 1.50E-10 | 1.15E-10 | 8.79E-11 | 1.02E-11 | 4.72E-14 | 4.64E-21 | 9.88E-26 | 1.43E-31 | 0.00E+00 |
| ZN 64 | 2.11E-03 | 2.12E-03 | 2.12E-03 | 2.12E-03 | 2.12E-03 | 2.12E-03 | 2.12E-03 | 2.12E-03 | 2.12E-03 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| ZN 65 | 1.32E-06 | 1.32E-06 | 1.31E-06 | 1.28E-06 | 1.21E-06 | 1.02E-06 | 9.11E-07 | 7.90E-07 | 4.74E-07 |
| ZN 66 | 1.28E-03 | 1.28E-03 | 1.28E-03 | 1.28E-03 | 1.28E-03 | 1.28E-03 | 1.28E-03 | 1.28E-03 | 1.28E-03 |
| ZN 67 | 9.11E-07 | 9.11E-07 | 9.11E-07 | 9.11E-07 | 9.11E-07 | 9.11E-07 | 9.11E-07 | 9.11E-07 | 9.11E-07 |
| ZN 68 | 5.16E-09 | 5.16E-09 | 5.16E-09 | 5.16E-09 | 5.16E-09 | 5.16E-09 | 5.16E-09 | 5.16E-09 | 5.16E-09 |
| ZN 69 | 4.42E-15 | 9.52E-17 | 2.84E-17 | 1.79E-21 | 5.67E-32 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| ZN 69M | 4.30E-15 | 1.28E-15 | 3.84E-16 | 2.42E-20 | 7.65E-31 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| GA 69 | 3.49E-12 | 3.50E-12 | 3.50E-12 | 3.50E-12 | 3.50E-12 | 3.50E-12 | 3.50E-12 | 3.50E-12 | 3.50E-12 |
| GE 70 | 5.87E-15 | 5.87E-15 | 5.87E-15 | 5.87E-15 | 5.87E-15 | 5.87E-15 | 5.87E-15 | 5.87E-15 | 5.87E-15 |
| SR 87 | 8.38E-15 | 8.38E-15 | 8.38E-15 | 8.38E-15 | 8.38E-15 | 8.38E-15 | 8.38E-15 | 8.38E-15 | 8.38E-15 |
| SR 88 | 1.04E-11 | 1.04E-11 | 1.04E-11 | 1.04E-11 | 1.04E-11 | 1.04E-11 | 1.04E-11 | 1.04E-11 | 1.04E-11 |
| SR 89 | 5.42E-12 | 5.34E-12 | 5.27E-12 | 4.72E-12 | 3.59E-12 | 1.58E-12 | 9.09E-13 | 4.58E-13 | 3.87E-14 |
| SR 90 | 1.46E-12 | 1.46E-12 | 1.46E-12 | 1.46E-12 | 1.45E-12 | 1.45E-12 | 1.44E-12 | 1.44E-12 | 1.42E-12 |
| SR 91 | 1.32E-15 | 2.29E-16 | 3.98E-17 | 3.28E-23 | 2.02E-38 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 89 | 2.10E-07 | 2.11E-07 | 2.11E-07 | 2.14E-07 | 2.15E-07 | 2.15E-07 | 2.15E-07 | 2.15E-07 | 2.15E-07 |
| Y 89M | 3.20E-13 | 2.59E-13 | 2.09E-13 | 3.84E-14 | 5.52E-16 | 1.64E-21 | 3.40E-25 | 8.45E-30 | 0.00E+00 |
| Y 90 | 2.18E-08 | 1.68E-08 | 1.30E-08 | 1.62E-09 | 8.97E-12 | 3.65E-16 | 3.62E-16 | 3.61E-16 | 3.57E-16 |
| Y 90M | 3.48E-16 | 1.63E-18 | 7.60E-21 | 1.72E-39 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 91 | 4.70E-11 | 4.65E-11 | 4.59E-11 | 4.18E-11 | 3.30E-11 | 1.62E-11 | 1.01E-11 | 5.57E-12 | 6.61E-13 |
| Y 92 | 6.29E-14 | 5.72E-16 | 5.20E-18 | 2.42E-34 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 94 | 3.25E-17 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| ZR 89 | 5.63E-09 | 4.56E-09 | 3.69E-09 | 6.76E-10 | 9.72E-12 | 2.90E-17 | 5.99E-21 | 1.49E-25 | 3.99E-42 |
| ZR 90 | 1.01E-06 | 1.01E-06 | 1.01E-06 | 1.03E-06 | 1.03E-06 | 1.03E-06 | 1.03E-06 | 1.03E-06 | 1.03E-06 |
| ZR 91 | 2.93E-06 | 2.93E-06 | 2.93E-06 | 2.93E-06 | 2.93E-06 | 2.93E-06 | 2.93E-06 | 2.93E-06 | 2.93E-06 |
| ZR 92 | 6.82E-05 | 6.84E-05 | 6.87E-05 | 7.00E-05 | 7.13E-05 | 7.18E-05 | 7.18E-05 | 7.18E-05 | 7.18E-05 |
| ZR 93 | 1.24E-05 | 1.24E-05 | 1.24E-05 | 1.24E-05 | 1.24E-05 | 1.24E-05 | 1.24E-05 | 1.24E-05 | 1.24E-05 |
| ZR 94 | 6.28E-06 | 6.28E-06 | 6.28E-06 | 6.28E-06 | 6.28E-06 | 6.28E-06 | 6.28E-06 | 6.28E-06 | 6.28E-06 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| ZR 95 | 2.72E-07 | 2.69E-07 | 2.66E-07 | 2.44E-07 | 1.97E-07 | 1.03E-07 | 6.65E-08 | 3.87E-08 | 5.51E-09 |
| ZR 96 | 5.55E-10 | 5.55E-10 | 5.55E-10 | 5.55E-10 | 5.55E-10 | 5.55E-10 | 5.55E-10 | 5.55E-10 | 5.55E-10 |
| ZR 97 | 1.05E-10 | 3.90E-11 | 1.46E-11 | 5.55E-15 | 1.56E-23 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 92 | 3.55E-06 | 3.32E-06 | 3.10E-06 | 1.80E-06 | 4.59E-07 | 7.65E-09 | 5.00E-10 | 1.65E-11 | 7.66E-17 |
| NB 93 | 3.59E+00 | 3.59E+00 | 3.59E+00 | 3.59E+00 | 3.59E+00 | 3.59E+00 | 3.59E+00 | 3.59E+00 | 3.59E+00 |
| NB 93M | 2.50E-12 | 2.51E-12 | 2.53E-12 | 2.64E-12 | 2.93E-12 | 3.78E-12 | 4.34E-12 | 5.04E-12 | 7.52E-12 |
| NB 94 | 2.29E-02 | 2.29E-02 | 2.29E-02 | 2.29E-02 | 2.29E-02 | 2.29E-02 | 2.29E-02 | 2.29E-02 | 2.29E-02 |
| NB 95 | 2.95E-04 | 2.89E-04 | 2.83E-04 | 2.42E-04 | 1.63E-04 | 5.00E-05 | 2.28E-05 | 8.51E-06 | 2.50E-07 |
| NB 95M | 1.09E-10 | 1.09E-10 | 1.08E-10 | 1.02E-10 | 8.22E-11 | 4.29E-11 | 2.79E-11 | 1.62E-11 | 2.30E-12 |
| NB 96 | 4.45E-08 | 2.18E-08 | 1.07E-08 | 3.58E-11 | 2.32E-17 | 6.33E-36 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 97 | 2.64E-10 | 2.79E-12 | 1.04E-12 | 4.25E-16 | 1.20E-24 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 97M | 9.75E-14 | 3.65E-14 | 1.36E-14 | 5.18E-18 | 1.46E-26 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 98 | 2.57E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB100 | 1.12E-15 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MO 92 | 1.47E+00 | 1.47E+00 | 1.47E+00 | 1.47E+00 | 1.47E+00 | 1.47E+00 | 1.47E+00 | 1.47E+00 | 1.47E+00 |
| MO 93M | 2.97E-08 | 2.62E-09 | 2.31E-10 | 8.43E-19 | 6.79E-40 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MO 93 | 4.00E-04 | 4.00E-04 | 4.00E-04 | 4.00E-04 | 4.00E-04 | 4.00E-04 | 4.00E-04 | 4.00E-04 | 4.00E-04 |
| MO 94 | 9.42E-01 | 9.42E-01 | 9.42E-01 | 9.42E-01 | 9.42E-01 | 9.42E-01 | 9.42E-01 | 9.42E-01 | 9.42E-01 |
| MO 95 | 1.52E+00 | 1.52E+00 | 1.52E+00 | 1.52E+00 | 1.52E+00 | 1.52E+00 | 1.52E+00 | 1.52E+00 | 1.52E+00 |
| MO 96 | 1.82E+00 | 1.82E+00 | 1.82E+00 | 1.82E+00 | 1.82E+00 | 1.82E+00 | 1.82E+00 | 1.82E+00 | 1.82E+00 |
| MO 97 | 1.01E+00 | 1.01E+00 | 1.01E+00 | 1.01E+00 | 1.01E+00 | 1.01E+00 | 1.01E+00 | 1.01E+00 | 1.01E+00 |
| MO 98 | 2.55E+00 | 2.55E+00 | 2.55E+00 | 2.55E+00 | 2.55E+00 | 2.55E+00 | 2.55E+00 | 2.55E+00 | 2.55E+00 |
| MO 99 | 2.13E-04 | 1.66E-04 | 1.29E-04 | 1.72E-05 | 1.11E-07 | 3.00E-14 | 1.26E-18 | 4.22E-24 | 1.39E-43 |
| MO100 | 1.03E+00 | 1.03E+00 | 1.03E+00 | 1.03E+00 | 1.03E+00 | 1.03E+00 | 1.03E+00 | 1.03E+00 | 1.03E+00 |
| MO101 | 2.00E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TC 99 | 1.10E-03 | 1.10E-03 | 1.11E-03 | 1.12E-03 | 1.13E-03 | 1.13E-03 | 1.13E-03 | 1.13E-03 | 1.13E-03 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| TC100 | 2.36E-10 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TC101 | 1.94E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RU 99 | 1.72E-09 | 1.73E-09 | 1.74E-09 | 1.82E-09 | 2.02E-09 | 2.62E-09 | 3.03E-09 | 3.53E-09 | 5.33E-09 |
| RU100 | 8.22E-05 | 8.22E-05 | 8.22E-05 | 8.22E-05 | 8.22E-05 | 8.22E-05 | 8.22E-05 | 8.22E-05 | 8.22E-05 |
| RU101 | 2.40E-03 | 2.40E-03 | 2.40E-03 | 2.40E-03 | 2.40E-03 | 2.40E-03 | 2.40E-03 | 2.40E-03 | 2.40E-03 |
| RU102 | 5.73E-05 | 5.73E-05 | 5.73E-05 | 5.73E-05 | 5.73E-05 | 5.73E-05 | 5.73E-05 | 5.73E-05 | 5.73E-05 |
| RU103 | 3.99E-08 | 3.92E-08 | 3.85E-08 | 3.35E-08 | 2.35E-08 | 8.15E-09 | 4.03E-09 | 1.67E-09 | 6.96E-11 |
| RU104 | 4.31E-10 | 4.31E-10 | 4.31E-10 | 4.31E-10 | 4.31E-10 | 4.31E-10 | 4.31E-10 | 4.31E-10 | 4.31E-10 |
| RU105 | 2.68E-15 | 6.31E-17 | 1.49E-18 | 1.42E-31 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH103 | 3.44E-09 | 3.51E-09 | 3.58E-09 | 4.08E-09 | 5.07E-09 | 6.60E-09 | 7.01E-09 | 7.24E-09 | 7.40E-09 |
| RH104 | 8.58E-15 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH104M | 3.82E-15 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH105 | 1.67E-14 | 1.23E-14 | 7.70E-15 | 1.79E-16 | 1.47E-20 | 8.08E-33 | 5.43E-41 | 0.00E+00 | 0.00E+00 |
| RH106M | 9.70E-17 | 5.05E-20 | 2.62E-23 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| PD104 | 5.64E-10 | 5.64E-10 | 5.64E-10 | 5.64E-10 | 5.64E-10 | 5.64E-10 | 5.64E-10 | 5.64E-10 | 5.64E-10 |
| PD105 | 1.44E-12 | 1.45E-12 | 1.45E-12 | 1.46E-12 | 1.46E-12 | 1.46E-12 | 1.46E-12 | 1.46E-12 | 1.46E-12 |
| PD106 | 9.50E-14 | 9.51E-14 | 9.51E-14 | 9.51E-14 | 9.51E-14 | 9.51E-14 | 9.51E-14 | 9.51E-14 | 9.51E-14 |
| PD107 | 7.16E-17 | 7.16E-17 | 7.16E-17 | 7.16E-17 | 7.16E-17 | 7.16E-17 | 7.16E-17 | 7.16E-17 | 7.16E-17 |
| TM172 | 6.70E-15 | 5.15E-15 | 3.97E-15 | 4.90E-16 | 2.62E-18 | 4.00E-25 | 1.14E-29 | 2.39E-35 | 0.00E+00 |
| TM173 | 7.78E-16 | 1.03E-16 | 1.37E-17 | 1.33E-24 | 3.88E-42 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| YB172 | 1.67E-13 | 1.69E-13 | 1.70E-13 | 1.73E-13 | 1.74E-13 | 1.74E-13 | 1.74E-13 | 1.74E-13 | 1.74E-13 |
| YB173 | 1.09E-13 | 1.10E-13 | 1.10E-13 | 1.10E-13 | 1.10E-13 | 1.10E-13 | 1.10E-13 | 1.10E-13 | 1.10E-13 |
| YB174 | 5.01E-15 | 5.01E-15 | 5.01E-15 | 5.01E-15 | 5.01E-15 | 5.01E-15 | 5.01E-15 | 5.01E-15 | 5.01E-15 |
| YB175 | 1.63E-17 | 1.38E-17 | 1.17E-17 | 3.12E-18 | 1.14E-19 | 5.57E-24 | 6.13E-24 | 1.57E-27 | 1.83E-40 |
| LU175 | 3.59E-06 | 3.61E-06 | 3.63E-06 | 3.77E-06 | 4.08E-06 | 4.71E-06 | 4.97E-06 | 5.17E-06 | 5.44E-06 |
| LU176 | 9.86E-08 | 9.86E-08 | 9.86E-08 | 9.86E-08 | 9.86E-08 | 9.86E-08 | 9.86E-08 | 9.86E-08 | 9.86E-08 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| LU176M | 1.18E-09 | 1.30E-11 | 1.43E-13 | 3.10E-29 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| LU177 | 1.58E-08 | 1.42E-08 | 1.28E-08 | 5.62E-09 | 7.15E-10 | 3.62E-12 | 1.84E-12 | 1.45E-12 | 6.49E-13 |
| LU177M | 3.26E-10 | 3.25E-10 | 3.23E-10 | 3.12E-10 | 2.85E-10 | 2.18E-10 | 1.82E-10 | 1.46E-10 | 6.52E-11 |
| HF174 | 6.32E-06 | 6.32E-06 | 6.32E-06 | 6.32E-06 | 6.32E-06 | 6.32E-06 | 6.32E-06 | 6.32E-06 | 6.32E-06 |
| HF175 | 1.90E-06 | 1.88E-06 | 1.86E-06 | 1.72E-06 | 1.41E-06 | 7.78E-07 | 5.24E-07 | 3.19E-07 | 5.37E-08 |
| HF176 | 2.99E-04 | 2.99E-04 | 2.99E-04 | 2.99E-04 | 2.99E-04 | 2.99E-04 | 2.99E-04 | 2.99E-04 | 2.99E-04 |
| HF177 | 8.51E-05 | 8.51E-05 | 8.51E-05 | 8.51E-05 | 8.51E-05 | 8.51E-05 | 8.51E-05 | 8.51E-05 | 8.51E-05 |
| HF178 | 1.74E-03 | 1.74E-03 | 1.74E-03 | 1.74E-03 | 1.74E-03 | 1.74E-03 | 1.74E-03 | 1.74E-03 | 1.74E-03 |
| HF178M | 3.15E-13 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| HF179 | 2.51E-03 | 2.51E-03 | 2.51E-03 | 2.51E-03 | 2.51E-03 | 2.51E-03 | 2.51E-03 | 2.51E-03 | 2.51E-03 |
| HF179M | 1.62E-09 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| HF180 | 3.31E-03 | 3.31E-03 | 3.31E-03 | 3.31E-03 | 3.31E-03 | 3.31E-03 | 3.31E-03 | 3.31E-03 | 3.31E-03 |
| HF180M | 1.03E-08 | 5.00E-10 | 2.43E-11 | 7.54E-22 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| HF181 | 2.72E-05 | 2.68E-05 | 2.64E-05 | 2.31E-05 | 1.67E-05 | 6.26E-06 | 3.25E-06 | 1.44E-06 | 7.57E-08 |
| HF182 | 8.83E-07 | 8.83E-07 | 8.83E-07 | 8.83E-07 | 8.83E-07 | 8.83E-07 | 8.83E-07 | 8.83E-07 | 8.83E-07 |
| TA180 | 1.07E-04 | 1.07E-04 | 1.07E-04 | 1.07E-04 | 1.07E-04 | 1.07E-04 | 1.07E-04 | 1.07E-04 | 1.07E-04 |
| TA181 | 2.05E+00 | 2.05E+00 | 2.05E+00 | 2.05E+00 | 2.05E+00 | 2.05E+00 | 2.05E+00 | 2.05E+00 | 2.05E+00 |
| TA182 | 5.33E-02 | 5.30E-02 | 5.26E-02 | 5.02E-02 | 4.45E-02 | 3.10E-02 | 2.43E-02 | 1.80E-02 | 6.09E-03 |
| TA182M | 2.81E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TA183 | 2.43E-02 | 2.12E-02 | 1.85E-02 | 6.23E-03 | 4.11E-04 | 1.18E-07 | 5.15E-10 | 5.75E-13 | 1.37E-23 |
| W180 | 9.76E-18 | 9.78E-18 | 9.79E-18 | 9.89E-18 | 1.01E-17 | 1.09E-17 | 1.14E-17 | 1.20E-17 | 1.43E-17 |
| W182 | 9.79E-02 | 9.83E-02 | 9.86E-02 | 1.01E-01 | 1.07E-01 | 1.20E-01 | 1.27E-01 | 1.33E-01 | 1.45E-01 |
| W183M | 3.44E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| W183 | 5.84E-01 | 5.87E-01 | 5.90E-01 | 6.02E-01 | 6.08E-01 | 6.09E-01 | 6.09E-01 | 6.09E-01 | 6.09E-01 |
| W184 | 4.24E-02 | 4.24E-02 | 4.24E-02 | 4.24E-02 | 4.24E-02 | 4.24E-02 | 4.24E-02 | 4.24E-02 | 4.24E-02 |
| W185 | 7.04E-05 | 6.98E-05 | 6.92E-05 | 6.42E-05 | 5.34E-05 | 3.07E-05 | 2.12E-05 | 1.34E-05 | 2.54E-06 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| W185M | 3.39E-12 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| W186 | 3.55E-07 | 3.63E-07 | 3.70E-07 | 3.95E-07 | 4.02E-07 | 4.03E-07 | 4.03E-07 | 4.03E-07 | 4.03E-07 |
| W187 | 6.88E-10 | 3.43E-10 | 1.71E-10 | 6.52E-13 | 5.87E-19 | 4.28E-37 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| W188 | 1.18E-10 | 1.17E-10 | 1.16E-10 | 1.07E-10 | 8.75E-11 | 4.81E-11 | 3.22E-11 | 1.96E-11 | 3.24E-12 |
| RE185 | 2.93E-05 | 3.00E-05 | 3.06E-05 | 3.55E-05 | 4.63E-05 | 6.91E-05 | 7.85E-05 | 8.64E-05 | 9.72E-05 |
| RE186 | 7.36E-07 | 6.13E-07 | 5.10E-07 | 1.17E-07 | 2.99E-09 | 4.93E-14 | 3.20E-17 | 3.31E-21 | 1.49E-35 |
| RE187 | 1.64E-08 | 1.67E-08 | 1.69E-08 | 1.71E-08 | 1.71E-08 | 1.71E-08 | 1.71E-08 | 1.71E-08 | 1.71E-08 |
| RE188 | 2.10E-11 | 8.76E-12 | 4.03E-12 | 1.10E-12 | 9.02E-13 | 4.95E-13 | 3.32E-13 | 2.02E-13 | 3.34E-14 |
| RE188M | 3.55E-13 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE189 | 4.99E-16 | 2.52E-16 | 1.27E-16 | 5.31E-19 | 6.01E-25 | 7.95E-43 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| OS186 | 5.35E-06 | 5.47E-06 | 5.56E-06 | 5.93E-06 | 6.04E-06 | 6.04E-06 | 6.04E-06 | 6.04E-06 | 6.04E-06 |
| OS188 | 5.94E-10 | 6.07E-10 | 6.13E-10 | 6.25E-10 | 6.45E-10 | 6.84E-10 | 7.00E-10 | 7.13E-10 | 7.30E-10 |
| OS189 | 4.67E-12 | 4.67E-12 | 4.67E-12 | 4.67E-12 | 4.67E-12 | 4.67E-12 | 4.67E-12 | 4.67E-12 | 4.67E-12 |
| OS190 | 1.83E-13 | 1.83E-13 | 1.83E-13 | 1.83E-13 | 1.83E-13 | 1.83E-13 | 1.83E-13 | 1.83E-13 | 1.83E-13 |
| OS191 | 3.01E-16 | 2.99E-16 | 2.88E-16 | 2.02E-16 | 8.22E-17 | 5.52E-18 | 9.13E-19 | 9.63E-20 | 2.93E-23 |
| OS191M | 1.57E-17 | 4.35E-18 | 1.21E-18 | 4.34E-23 | 3.33E-34 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| IR191 | 1.95E-16 | 2.09E-16 | 2.22E-16 | 3.09E-16 | 4.29E-16 | 5.06E-16 | 5.11E-16 | 5.11E-16 | 5.11E-16 |
| IR192 | 3.72E-17 | 3.69E-17 | 3.65E-17 | 3.39E-17 | 2.81E-17 | 1.60E-17 | 1.10E-17 | 6.90E-18 | 1.28E-18 |
| PT192 | 5.22E-18 | 5.55E-18 | 5.87E-18 | 8.38E-18 | 1.39E-17 | 2.54E-17 | 3.02E-17 | 3.41E-17 | 3.94E-17 |
| SUMTOT | 7.33E+02 | 7.33E+02 | 7.33E+02 | 7.33E+02 | 7.33E+02 | 7.33E+02 | 7.33E+02 | 7.33E+02 | 7.33E+02 |
| 0TOTAL | 7.33E+02 | 7.33E+02 | 7.33E+02 | 7.33E+02 | 7.33E+02 | 7.33E+02 | 7.33E+02 | 7.33E+02 | 7.33E+02 |

Table 23. Source Terms for 'A7 400C 3 DPA Y' Capsule.

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| H 1 | 7.64E-04 | 7.64E-04 | 7.64E-04 | 7.64E-04 | 7.64E-04 | 7.64E-04 | 7.64E-04 | 7.64E-04 | 7.64E-04 |
| H 2 | 3.86E-07 | 3.86E-07 | 3.86E-07 | 3.86E-07 | 3.86E-07 | 3.86E-07 | 3.86E-07 | 3.86E-07 | 3.86E-07 |
| H 3 | 1.07E-08 | 1.07E-08 | 1.07E-08 | 1.07E-08 | 1.06E-08 | 1.05E-08 | 1.05E-08 | 1.04E-08 | 1.01E-08 |
| HE 3 | 4.60E-11 | 4.76E-11 | 4.92E-11 | 6.24E-11 | 9.51E-11 | 1.93E-10 | 2.57E-10 | 3.38E-10 | 6.21E-10 |
| HE 4 | 1.27E-02 | 1.27E-02 | 1.27E-02 | 1.27E-02 | 1.27E-02 | 1.27E-02 | 1.27E-02 | 1.27E-02 | 1.27E-02 |
| HE 6 | 6.90E-17 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| LI 6 | 2.10E-10 | 2.10E-10 | 2.10E-10 | 2.10E-10 | 2.10E-10 | 2.10E-10 | 2.10E-10 | 2.10E-10 | 2.10E-10 |
| LI 7 | 2.27E-13 | 2.27E-13 | 2.27E-13 | 2.27E-13 | 2.27E-13 | 2.27E-13 | 2.27E-13 | 2.27E-13 | 2.27E-13 |
| BE 9 | 2.49E-06 | 2.49E-06 | 2.49E-06 | 2.49E-06 | 2.49E-06 | 2.49E-06 | 2.49E-06 | 2.49E-06 | 2.49E-06 |
| BE 10 | 6.37E-08 | 6.37E-08 | 6.37E-08 | 6.37E-08 | 6.37E-08 | 6.37E-08 | 6.37E-08 | 6.37E-08 | 6.37E-08 |
| B 10 | 1.25E-13 | 1.25E-13 | 1.25E-13 | 1.25E-13 | 1.27E-13 | 1.32E-13 | 1.35E-13 | 1.38E-13 | 1.52E-13 |
| B 11 | 8.38E-05 | 8.38E-05 | 8.38E-05 | 8.38E-05 | 8.38E-05 | 8.38E-05 | 8.38E-05 | 8.38E-05 | 8.38E-05 |
| C 12 | 5.88E-01 | 5.88E-01 | 5.88E-01 | 5.88E-01 | 5.88E-01 | 5.88E-01 | 5.88E-01 | 5.88E-01 | 5.88E-01 |
| C 13 | 7.16E-03 | 7.16E-03 | 7.16E-03 | 7.16E-03 | 7.16E-03 | 7.16E-03 | 7.16E-03 | 7.16E-03 | 7.16E-03 |
| C 14 | 7.36E-04 | 7.36E-04 | 7.36E-04 | 7.36E-04 | 7.36E-04 | 7.36E-04 | 7.36E-04 | 7.36E-04 | 7.35E-04 |
| N 14 | 2.79E-01 | 2.79E-01 | 2.79E-01 | 2.79E-01 | 2.79E-01 | 2.79E-01 | 2.79E-01 | 2.79E-01 | 2.79E-01 |
| N 15 | 1.13E-03 | 1.13E-03 | 1.13E-03 | 1.13E-03 | 1.13E-03 | 1.13E-03 | 1.13E-03 | 1.13E-03 | 1.13E-03 |
| N 16 | 2.55E-17 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| O 16 | 3.82E-11 | 3.82E-11 | 3.82E-11 | 3.82E-11 | 3.82E-11 | 3.82E-11 | 3.82E-11 | 3.82E-11 | 3.82E-11 |
| O 17 | 4.16E-17 | 4.16E-17 | 4.16E-17 | 4.16E-17 | 4.16E-17 | 4.16E-17 | 4.16E-17 | 4.16E-17 | 4.16E-17 |
| O 18 | 3.77E-09 | 3.77E-09 | 3.77E-09 | 3.77E-09 | 3.77E-09 | 3.77E-09 | 3.77E-09 | 3.77E-09 | 3.77E-09 |
| F 19 | 6.33E-16 | 6.33E-16 | 6.33E-16 | 6.33E-16 | 6.33E-16 | 6.33E-16 | 6.33E-16 | 6.33E-16 | 6.33E-16 |
| NE 20 | 1.46E-12 | 1.46E-12 | 1.46E-12 | 1.46E-12 | 1.46E-12 | 1.46E-12 | 1.46E-12 | 1.46E-12 | 1.46E-12 |
| NE 21 | 4.39E-06 | 4.39E-06 | 4.39E-06 | 4.39E-06 | 4.39E-06 | 4.39E-06 | 4.39E-06 | 4.39E-06 | 4.39E-06 |
| NE 22 | 6.60E-06 | 6.60E-06 | 6.60E-06 | 6.60E-06 | 6.60E-06 | 6.60E-06 | 6.60E-06 | 6.60E-06 | 6.60E-06 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| NE 23 | 4.62E-12 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NA 23 | 1.34E-06 | 1.34E-06 | 1.34E-06 | 1.34E-06 | 1.34E-06 | 1.34E-06 | 1.34E-06 | 1.34E-06 | 1.34E-06 |
| NA 24 | 1.72E-06 | 5.67E-07 | 1.87E-07 | 2.62E-11 | 6.10E-21 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NA 25 | 4.86E-12 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MG 24 | 7.52E-01 | 7.52E-01 | 7.52E-01 | 7.52E-01 | 7.52E-01 | 7.52E-01 | 7.52E-01 | 7.52E-01 | 7.52E-01 |
| MG 25 | 9.91E-02 | 9.91E-02 | 9.91E-02 | 9.91E-02 | 9.91E-02 | 9.91E-02 | 9.91E-02 | 9.91E-02 | 9.91E-02 |
| MG 26 | 1.14E-01 | 1.14E-01 | 1.14E-01 | 1.14E-01 | 1.14E-01 | 1.14E-01 | 1.14E-01 | 1.14E-01 | 1.14E-01 |
| MG 27 | 9.62E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MG 28 | 3.72E-14 | 1.68E-14 | 7.57E-15 | 1.30E-17 | 1.61E-24 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AL 27 | 1.32E+02 | 1.32E+02 | 1.32E+02 | 1.32E+02 | 1.32E+02 | 1.32E+02 | 1.32E+02 | 1.32E+02 | 1.32E+02 |
| AL 28 | 5.65E-07 | 3.00E-17 | 1.35E-17 | 2.33E-20 | 2.87E-27 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AL 29 | 4.29E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AL 30 | 4.04E-16 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SI 28 | 1.91E+00 | 1.91E+00 | 1.91E+00 | 1.91E+00 | 1.91E+00 | 1.91E+00 | 1.91E+00 | 1.91E+00 | 1.91E+00 |
| SI 29 | 9.84E-02 | 9.84E-02 | 9.84E-02 | 9.84E-02 | 9.84E-02 | 9.84E-02 | 9.84E-02 | 9.84E-02 | 9.84E-02 |
| SI 30 | 6.73E-02 | 6.73E-02 | 6.73E-02 | 6.73E-02 | 6.73E-02 | 6.73E-02 | 6.73E-02 | 6.73E-02 | 6.73E-02 |
| SI 31 | 1.68E-08 | 2.96E-11 | 5.19E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SI 32 | 1.07E-11 | 1.07E-11 | 1.07E-11 | 1.07E-11 | 1.07E-11 | 1.07E-11 | 1.07E-11 | 1.07E-11 | 1.07E-11 |
| P 31 | 5.70E-02 | 5.70E-02 | 5.70E-02 | 5.70E-02 | 5.70E-02 | 5.70E-02 | 5.70E-02 | 5.70E-02 | 5.70E-02 |
| P 32 | 2.62E-06 | 2.50E-06 | 2.38E-06 | 1.61E-06 | 6.12E-07 | 3.34E-08 | 4.80E-09 | 4.26E-10 | 6.98E-14 |
| P 33 | 1.50E-10 | 1.46E-10 | 1.42E-10 | 1.14E-10 | 6.54E-11 | 1.24E-11 | 4.08E-12 | 1.02E-12 | 6.95E-15 |
| P 34 | 5.55E-15 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| S 32 | 3.67E-02 | 3.67E-02 | 3.67E-02 | 3.67E-02 | 3.67E-02 | 3.67E-02 | 3.67E-02 | 3.67E-02 | 3.67E-02 |
| S 33 | 3.25E-04 | 3.25E-04 | 3.25E-04 | 3.25E-04 | 3.25E-04 | 3.25E-04 | 3.25E-04 | 3.25E-04 | 3.25E-04 |
| S 34 | 1.73E-03 | 1.73E-03 | 1.73E-03 | 1.73E-03 | 1.73E-03 | 1.73E-03 | 1.73E-03 | 1.73E-03 | 1.73E-03 |
| S 35 | 2.36E-07 | 2.34E-07 | 2.32E-07 | 2.18E-07 | 1.86E-07 | 1.16E-07 | 8.47E-08 | 5.71E-08 | 1.38E-08 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| S 36 | 7.38E-06 | 7.38E-06 | 7.38E-06 | 7.38E-06 | 7.38E-06 | 7.38E-06 | 7.38E-06 | 7.38E-06 | 7.38E-06 |
| S 37 | 4.27E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CL 35 | 3.25E-07 | 3.27E-07 | 3.29E-07 | 3.43E-07 | 3.75E-07 | 4.45E-07 | 4.76E-07 | 5.04E-07 | 5.47E-07 |
| CL 36 | 9.07E-09 | 9.07E-09 | 9.07E-09 | 9.07E-09 | 9.07E-09 | 9.07E-09 | 9.07E-09 | 9.07E-09 | 9.07E-09 |
| CL 37 | 1.56E-09 | 1.56E-09 | 1.56E-09 | 1.56E-09 | 1.56E-09 | 1.56E-09 | 1.56E-09 | 1.56E-09 | 1.56E-09 |
| CL 38 | 2.03E-16 | 4.57E-28 | 1.03E-39 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AR 36 | 4.11E-15 | 4.17E-15 | 4.23E-15 | 4.68E-15 | 5.80E-15 | 9.16E-15 | 1.14E-14 | 1.42E-14 | 2.43E-14 |
| AR 38 | 4.84E-13 | 4.84E-13 | 4.84E-13 | 4.84E-13 | 4.84E-13 | 4.84E-13 | 4.84E-13 | 4.84E-13 | 4.84E-13 |
| AR 39 | 1.48E-16 | 1.48E-16 | 1.48E-16 | 1.48E-16 | 1.48E-16 | 1.48E-16 | 1.48E-16 | 1.47E-16 | 1.47E-16 |
| AR 40 | 3.14E-17 | 3.14E-17 | 3.14E-17 | 3.14E-17 | 3.14E-17 | 3.14E-17 | 3.14E-17 | 3.14E-17 | 3.14E-17 |
| CA 44 | 1.57E-10 | 1.57E-10 | 1.57E-10 | 1.57E-10 | 1.57E-10 | 1.57E-10 | 1.57E-10 | 1.57E-10 | 1.57E-10 |
| CA 45 | 5.91E-14 | 5.89E-14 | 5.86E-14 | 5.67E-14 | 5.21E-14 | 4.03E-14 | 3.40E-14 | 2.75E-14 | 1.28E-14 |
| CA 46 | 6.29E-11 | 6.29E-11 | 6.29E-11 | 6.29E-11 | 6.29E-11 | 6.29E-11 | 6.29E-11 | 6.29E-11 | 6.29E-11 |
| CA 47 | 1.13E-14 | 9.73E-15 | 8.35E-15 | 2.46E-15 | 1.16E-16 | 1.21E-20 | 2.51E-23 | 1.20E-26 | 1.36E-38 |
| SC 45 | 1.48E-14 | 1.50E-14 | 1.53E-14 | 1.72E-14 | 2.18E-14 | 3.36E-14 | 3.99E-14 | 4.64E-14 | 6.11E-14 |
| SC 46 | 1.02E-16 | 1.01E-16 | 1.01E-16 | 9.41E-17 | 7.98E-17 | 4.86E-17 | 3.49E-17 | 2.31E-17 | 5.20E-18 |
| SC 47 | 3.58E-11 | 2.91E-11 | 2.37E-11 | 4.53E-12 | 7.25E-14 | 3.28E-19 | 1.59E-22 | 3.69E-26 | 2.50E-42 |
| SC 48 | 4.53E-11 | 3.10E-11 | 2.12E-11 | 1.02E-12 | 5.11E-16 | 6.49E-26 | 1.64E-32 | 9.32E-41 | 0.00E+00 |
| SC 49 | 1.22E-13 | 3.52E-21 | 1.02E-28 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SC 50 | 3.16E-16 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TI 46 | 3.70E-17 | 3.78E-17 | 3.87E-17 | 4.51E-17 | 5.95E-17 | 9.07E-17 | 1.04E-16 | 1.16E-16 | 1.34E-16 |
| TI 47 | 1.36E-05 | 1.36E-05 | 1.36E-05 | 1.36E-05 | 1.36E-05 | 1.36E-05 | 1.36E-05 | 1.36E-05 | 1.36E-05 |
| TI 48 | 2.08E-08 | 2.08E-08 | 2.08E-08 | 2.08E-08 | 2.08E-08 | 2.08E-08 | 2.08E-08 | 2.08E-08 | 2.08E-08 |
| TI 49 | 3.72E-05 | 3.72E-05 | 3.72E-05 | 3.72E-05 | 3.72E-05 | 3.72E-05 | 3.72E-05 | 3.72E-05 | 3.72E-05 |
| TI 50 | 1.50E-04 | 1.50E-04 | 1.50E-04 | 1.50E-04 | 1.50E-04 | 1.50E-04 | 1.50E-04 | 1.50E-04 | 1.50E-04 |
| TI 51 | 2.45E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| V 50 | 8.05E-04 | 8.05E-04 | 8.05E-04 | 8.05E-04 | 8.05E-04 | 8.05E-04 | 8.05E-04 | 8.05E-04 | 8.05E-04 |
| V 51 | 2.09E-01 | 2.10E-01 | 2.10E-01 | 2.14E-01 | 2.20E-01 | 2.28E-01 | 2.29E-01 | 2.30E-01 | 2.30E-01 |
| V 52 | 4.43E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| V 53 | 4.73E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| V 54 | 2.97E-13 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CR 50 | 4.97E+00 | 4.97E+00 | 4.97E+00 | 4.97E+00 | 4.97E+00 | 4.97E+00 | 4.97E+00 | 4.97E+00 | 4.97E+00 |
| CR 51 | 2.07E-02 | 2.02E-02 | 1.97E-02 | 1.61E-02 | 9.78E-03 | 2.18E-03 | 8.02E-04 | 2.30E-04 | 2.54E-06 |
| CR 52 | 1.01E+02 | 1.01E+02 | 1.01E+02 | 1.01E+02 | 1.01E+02 | 1.01E+02 | 1.01E+02 | 1.01E+02 | 1.01E+02 |
| CR 53 | 1.20E+01 | 1.20E+01 | 1.20E+01 | 1.20E+01 | 1.20E+01 | 1.20E+01 | 1.20E+01 | 1.20E+01 | 1.20E+01 |
| CR 54 | 3.27E+00 | 3.27E+00 | 3.27E+00 | 3.27E+00 | 3.27E+00 | 3.28E+00 | 3.28E+00 | 3.28E+00 | 3.28E+00 |
| CR 55 | 3.26E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MN 54 | 5.95E-03 | 5.93E-03 | 5.92E-03 | 5.82E-03 | 5.56E-03 | 4.87E-03 | 4.46E-03 | 3.99E-03 | 2.68E-03 |
| MN 55 | 5.48E+00 | 5.48E+00 | 5.48E+00 | 5.48E+00 | 5.48E+00 | 5.48E+00 | 5.49E+00 | 5.49E+00 | 5.50E+00 |
| MN 56 | 1.16E-04 | 1.83E-07 | 2.88E-10 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MN 57 | 2.07E-10 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MN 58 | 4.23E-13 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FE 54 | 2.84E+01 | 2.84E+01 | 2.84E+01 | 2.84E+01 | 2.84E+01 | 2.84E+01 | 2.84E+01 | 2.84E+01 | 2.84E+01 |
| FE 55 | 7.97E-02 | 7.96E-02 | 7.96E-02 | 7.91E-02 | 7.80E-02 | 7.46E-02 | 7.25E-02 | 6.99E-02 | 6.13E-02 |
| FE 56 | 4.65E+02 | 4.65E+02 | 4.65E+02 | 4.65E+02 | 4.65E+02 | 4.65E+02 | 4.65E+02 | 4.65E+02 | 4.65E+02 |
| FE 57 | 1.30E+01 | 1.30E+01 | 1.30E+01 | 1.30E+01 | 1.30E+01 | 1.30E+01 | 1.30E+01 | 1.30E+01 | 1.30E+01 |
| FE 58 | 1.57E+00 | 1.57E+00 | 1.57E+00 | 1.57E+00 | 1.57E+00 | 1.57E+00 | 1.58E+00 | 1.58E+00 | 1.58E+00 |
| FE 59 | 7.68E-04 | 7.56E-04 | 7.44E-04 | 6.58E-04 | 4.84E-04 | 1.92E-04 | 1.04E-04 | 4.80E-05 | 3.00E-06 |
| CO 58 | 2.21E-03 | 2.19E-03 | 2.17E-03 | 2.00E-03 | 1.65E-03 | 9.16E-04 | 6.19E-04 | 3.79E-04 | 6.51E-05 |
| CO 59 | 9.34E-03 | 9.35E-03 | 9.36E-03 | 9.45E-03 | 9.63E-03 | 9.92E-03 | 1.00E-02 | 1.01E-02 | 1.01E-02 |
| CO 60 | 4.50E-04 | 4.50E-04 | 4.49E-04 | 4.48E-04 | 4.45E-04 | 4.35E-04 | 4.29E-04 | 4.21E-04 | 3.95E-04 |
| CO 60M | 2.10E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| CO 61 | 4.83E-09 | 2.02E-13 | 8.44E-18 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CO 62 | 1.09E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NI 58 | 4.86E+01 | 4.86E+01 | 4.86E+01 | 4.86E+01 | 4.86E+01 | 4.86E+01 | 4.86E+01 | 4.86E+01 | 4.86E+01 |
| NI 59 | 3.22E-01 | 3.22E-01 | 3.22E-01 | 3.22E-01 | 3.22E-01 | 3.22E-01 | 3.22E-01 | 3.22E-01 | 3.22E-01 |
| NI 60 | 1.93E+01 | 1.93E+01 | 1.93E+01 | 1.93E+01 | 1.93E+01 | 1.93E+01 | 1.93E+01 | 1.93E+01 | 1.93E+01 |
| NI 61 | 9.24E-01 | 9.24E-01 | 9.24E-01 | 9.24E-01 | 9.24E-01 | 9.24E-01 | 9.24E-01 | 9.24E-01 | 9.24E-01 |
| NI 62 | 2.70E+00 | 2.70E+00 | 2.70E+00 | 2.70E+00 | 2.70E+00 | 2.70E+00 | 2.70E+00 | 2.70E+00 | 2.70E+00 |
| NI 63 | 5.20E-02 | 5.20E-02 | 5.20E-02 | 5.20E-02 | 5.19E-02 | 5.19E-02 | 5.18E-02 | 5.18E-02 | 5.16E-02 |
| NI 64 | 7.21E-01 | 7.21E-01 | 7.21E-01 | 7.21E-01 | 7.21E-01 | 7.21E-01 | 7.21E-01 | 7.21E-01 | 7.21E-01 |
| NI 65 | 1.32E-06 | 1.79E-09 | 2.43E-12 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NI 66 | 7.91E-10 | 5.83E-10 | 4.30E-10 | 3.76E-11 | 8.50E-14 | 9.81E-22 | 5.01E-27 | 1.22E-33 | 0.00E+00 |
| CU 63 | 3.33E-01 | 3.33E-01 | 3.33E-01 | 3.33E-01 | 3.33E-01 | 3.33E-01 | 3.33E-01 | 3.33E-01 | 3.33E-01 |
| CU 64 | 1.01E-05 | 2.72E-06 | 7.33E-07 | 2.06E-11 | 8.64E-23 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CU 65 | 1.55E-01 | 1.55E-01 | 1.55E-01 | 1.55E-01 | 1.55E-01 | 1.55E-01 | 1.55E-01 | 1.55E-01 | 1.55E-01 |
| CU 66 | 1.52E-08 | 9.10E-13 | 6.71E-13 | 5.86E-14 | 1.33E-16 | 1.53E-24 | 7.82E-30 | 1.90E-36 | 0.00E+00 |
| CU 67 | 5.73E-11 | 4.38E-11 | 3.35E-11 | 3.89E-12 | 1.80E-14 | 1.77E-21 | 3.76E-26 | 5.44E-32 | 0.00E+00 |
| ZN 64 | 8.83E-04 | 8.86E-04 | 8.87E-04 | 8.87E-04 | 8.87E-04 | 8.87E-04 | 8.87E-04 | 8.87E-04 | 8.87E-04 |
| ZN 65 | 5.05E-07 | 5.03E-07 | 5.02E-07 | 4.90E-07 | 4.63E-07 | 3.91E-07 | 3.49E-07 | 3.03E-07 | 1.81E-07 |
| ZN 66 | 5.33E-04 | 5.33E-04 | 5.33E-04 | 5.33E-04 | 5.33E-04 | 5.33E-04 | 5.33E-04 | 5.33E-04 | 5.33E-04 |
| ZN 67 | 3.48E-07 | 3.48E-07 | 3.48E-07 | 3.48E-07 | 3.48E-07 | 3.48E-07 | 3.48E-07 | 3.48E-07 | 3.48E-07 |
| ZN 68 | 1.80E-09 | 1.80E-09 | 1.80E-09 | 1.80E-09 | 1.80E-09 | 1.80E-09 | 1.80E-09 | 1.80E-09 | 1.80E-09 |
| ZN 69 | 1.41E-15 | 3.04E-17 | 9.08E-18 | 5.73E-22 | 1.81E-32 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| ZN 69M | 1.37E-15 | 4.10E-16 | 1.22E-16 | 7.72E-21 | 2.44E-31 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| GA 69 | 1.12E-12 | 1.12E-12 | 1.12E-12 | 1.12E-12 | 1.12E-12 | 1.12E-12 | 1.12E-12 | 1.12E-12 | 1.12E-12 |
| GE 70 | 1.71E-15 | 1.72E-15 | 1.72E-15 | 1.72E-15 | 1.72E-15 | 1.72E-15 | 1.72E-15 | 1.72E-15 | 1.72E-15 |
| SR 87 | 6.77E-17 | 6.77E-17 | 6.77E-17 | 6.77E-17 | 6.77E-17 | 6.77E-17 | 6.77E-17 | 6.77E-17 | 6.77E-17 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| SR 88 | 2.66E-12 | 2.66E-12 | 2.66E-12 | 2.66E-12 | 2.66E-12 | 2.66E-12 | 2.66E-12 | 2.66E-12 | 2.66E-12 |
| SR 89 | 1.39E-12 | 1.37E-12 | 1.36E-12 | 1.21E-12 | 9.23E-13 | 4.05E-13 | 2.34E-13 | 1.18E-13 | 9.95E-15 |
| SR 90 | 8.45E-14 | 8.45E-14 | 8.45E-14 | 8.45E-14 | 8.44E-14 | 8.40E-14 | 8.38E-14 | 8.35E-14 | 8.26E-14 |
| SR 91 | 3.33E-16 | 5.78E-17 | 1.00E-17 | 8.27E-24 | 5.10E-39 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 89 | 5.89E-08 | 5.92E-08 | 5.95E-08 | 6.03E-08 | 6.05E-08 | 6.05E-08 | 6.05E-08 | 6.05E-08 | 6.05E-08 |
| Y 89M | 8.99E-14 | 7.27E-14 | 5.88E-14 | 1.08E-14 | 1.55E-16 | 4.62E-22 | 9.57E-26 | 2.38E-30 | 0.00E+00 |
| Y 90 | 1.94E-10 | 1.50E-10 | 1.16E-10 | 1.45E-11 | 7.98E-14 | 2.11E-17 | 2.10E-17 | 2.10E-17 | 2.07E-17 |
| Y 90M | 8.95E-17 | 4.18E-19 | 1.95E-21 | 4.42E-40 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 91 | 6.36E-13 | 6.28E-13 | 6.21E-13 | 5.65E-13 | 4.46E-13 | 2.19E-13 | 1.36E-13 | 7.54E-14 | 8.93E-15 |
| Y 92 | 1.61E-14 | 1.47E-16 | 1.33E-18 | 6.20E-35 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| ZR 89 | 1.58E-09 | 1.28E-09 | 1.04E-09 | 1.90E-10 | 2.73E-12 | 8.14E-18 | 1.68E-21 | 4.18E-26 | 1.12E-42 |
| ZR 90 | 8.89E-09 | 8.94E-09 | 8.97E-09 | 9.07E-09 | 9.09E-09 | 9.09E-09 | 9.09E-09 | 9.09E-09 | 9.09E-09 |
| ZR 91 | 8.22E-07 | 8.22E-07 | 8.22E-07 | 8.22E-07 | 8.22E-07 | 8.22E-07 | 8.22E-07 | 8.22E-07 | 8.22E-07 |
| ZR 92 | 1.92E-05 | 1.93E-05 | 1.93E-05 | 1.97E-05 | 2.01E-05 | 2.02E-05 | 2.02E-05 | 2.02E-05 | 2.02E-05 |
| ZR 93 | 7.93E-07 | 7.93E-07 | 7.93E-07 | 7.93E-07 | 7.93E-07 | 7.93E-07 | 7.93E-07 | 7.93E-07 | 7.93E-07 |
| ZR 94 | 1.74E-06 | 1.74E-06 | 1.74E-06 | 1.74E-06 | 1.74E-06 | 1.74E-06 | 1.74E-06 | 1.74E-06 | 1.74E-06 |
| ZR 95 | 7.65E-08 | 7.56E-08 | 7.48E-08 | 6.86E-08 | 5.53E-08 | 2.88E-08 | 1.87E-08 | 1.09E-08 | 1.55E-09 |
| ZR 96 | 1.43E-10 | 1.43E-10 | 1.43E-10 | 1.43E-10 | 1.43E-10 | 1.43E-10 | 1.43E-10 | 1.43E-10 | 1.43E-10 |
| ZR 97 | 2.94E-11 | 1.10E-11 | 4.10E-12 | 1.56E-15 | 4.39E-24 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 92 | 9.98E-07 | 9.32E-07 | 8.71E-07 | 5.05E-07 | 1.29E-07 | 2.15E-09 | 1.40E-10 | 4.63E-12 | 2.15E-17 |
| NB 93 | 3.45E-02 | 3.45E-02 | 3.45E-02 | 3.45E-02 | 3.45E-02 | 3.45E-02 | 3.45E-02 | 3.45E-02 | 3.45E-02 |
| NB 93M | 1.58E-13 | 1.59E-13 | 1.59E-13 | 1.67E-13 | 1.85E-13 | 2.39E-13 | 2.75E-13 | 3.20E-13 | 4.78E-13 |
| NB 94 | 2.03E-04 | 2.03E-04 | 2.03E-04 | 2.03E-04 | 2.03E-04 | 2.03E-04 | 2.03E-04 | 2.03E-04 | 2.03E-04 |
| NB 95 | 2.48E-06 | 2.43E-06 | 2.38E-06 | 2.04E-06 | 1.39E-06 | 4.39E-07 | 2.06E-07 | 8.18E-08 | 3.86E-09 |
| NB 95M | 3.07E-11 | 3.06E-11 | 3.04E-11 | 2.85E-11 | 2.31E-11 | 1.21E-11 | 7.83E-12 | 4.55E-12 | 6.48E-13 |
| NB 96 | 3.91E-09 | 1.92E-09 | 9.39E-10 | 3.14E-12 | 2.04E-18 | 5.56E-37 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| NB 97 | 7.43E-11 | 7.84E-13 | 2.93E-13 | 1.20E-16 | 3.37E-25 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 97M | 2.74E-14 | 1.03E-14 | 3.83E-15 | 1.46E-18 | 4.11E-27 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 98 | 7.23E-15 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB100 | 3.14E-16 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MO 92 | 4.51E-01 | 4.51E-01 | 4.51E-01 | 4.51E-01 | 4.51E-01 | 4.51E-01 | 4.51E-01 | 4.51E-01 | 4.51E-01 |
| MO 93M | 8.35E-09 | 7.36E-10 | 6.49E-11 | 2.37E-19 | 1.91E-40 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MO 93 | 1.13E-04 | 1.13E-04 | 1.13E-04 | 1.13E-04 | 1.13E-04 | 1.13E-04 | 1.13E-04 | 1.13E-04 | 1.13E-04 |
| MO 94 | 2.90E-01 | 2.90E-01 | 2.90E-01 | 2.90E-01 | 2.90E-01 | 2.90E-01 | 2.90E-01 | 2.90E-01 | 2.90E-01 |
| MO 95 | 4.71E-01 | 4.71E-01 | 4.71E-01 | 4.71E-01 | 4.71E-01 | 4.71E-01 | 4.71E-01 | 4.71E-01 | 4.71E-01 |
| MO 96 | 5.56E-01 | 5.56E-01 | 5.56E-01 | 5.56E-01 | 5.56E-01 | 5.56E-01 | 5.56E-01 | 5.56E-01 | 5.56E-01 |
| MO 97 | 3.11E-01 | 3.11E-01 | 3.11E-01 | 3.11E-01 | 3.11E-01 | 3.11E-01 | 3.11E-01 | 3.11E-01 | 3.11E-01 |
| MO 98 | 7.84E-01 | 7.84E-01 | 7.84E-01 | 7.84E-01 | 7.84E-01 | 7.84E-01 | 7.84E-01 | 7.84E-01 | 7.84E-01 |
| MO 99 | 5.99E-05 | 4.66E-05 | 3.62E-05 | 4.82E-06 | 3.12E-08 | 8.43E-15 | 3.53E-19 | 1.19E-24 | 0.00E+00 |
| MO100 | 3.18E-01 | 3.18E-01 | 3.18E-01 | 3.18E-01 | 3.18E-01 | 3.18E-01 | 3.18E-01 | 3.18E-01 | 3.18E-01 |
| MO101 | 5.61E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TC 99 | 3.11E-04 | 3.12E-04 | 3.14E-04 | 3.17E-04 | 3.18E-04 | 3.18E-04 | 3.18E-04 | 3.18E-04 | 3.18E-04 |
| TC100 | 6.09E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TC101 | 5.45E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RU 99 | 4.87E-10 | 4.90E-10 | 4.93E-10 | 5.15E-10 | 5.72E-10 | 7.42E-10 | 8.55E-10 | 9.97E-10 | 1.51E-09 |
| RU100 | 2.12E-05 | 2.12E-05 | 2.12E-05 | 2.12E-05 | 2.12E-05 | 2.12E-05 | 2.12E-05 | 2.12E-05 | 2.12E-05 |
| RU101 | 6.77E-04 | 6.77E-04 | 6.77E-04 | 6.77E-04 | 6.77E-04 | 6.77E-04 | 6.77E-04 | 6.77E-04 | 6.77E-04 |
| RU102 | 1.47E-05 | 1.47E-05 | 1.47E-05 | 1.47E-05 | 1.47E-05 | 1.47E-05 | 1.47E-05 | 1.47E-05 | 1.47E-05 |
| RU103 | 9.39E-09 | 9.22E-09 | 9.06E-09 | 7.87E-09 | 5.53E-09 | 1.92E-09 | 9.47E-10 | 3.92E-10 | 1.64E-11 |
| RU104 | 9.26E-11 | 9.26E-11 | 9.26E-11 | 9.26E-11 | 9.26E-11 | 9.26E-11 | 9.26E-11 | 9.26E-11 | 9.26E-11 |
| RU105 | 5.26E-16 | 1.24E-17 | 2.92E-19 | 2.79E-32 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH103 | 8.19E-10 | 8.36E-10 | 8.52E-10 | 9.70E-10 | 1.20E-09 | 1.56E-09 | 1.66E-09 | 1.71E-09 | 1.75E-09 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| RH104 | 1.87E-15 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH104M | 8.32E-16 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH105 | 3.34E-15 | 2.45E-15 | 1.54E-15 | 3.57E-17 | 2.93E-21 | 1.61E-33 | 1.09E-41 | 0.00E+00 | 0.00E+00 |
| RH106M | 1.78E-17 | 9.23E-21 | 4.80E-24 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| PD104 | 1.22E-10 | 1.22E-10 | 1.22E-10 | 1.22E-10 | 1.22E-10 | 1.22E-10 | 1.22E-10 | 1.22E-10 | 1.22E-10 |
| PD105 | 2.86E-13 | 2.87E-13 | 2.88E-13 | 2.89E-13 | 2.89E-13 | 2.89E-13 | 2.89E-13 | 2.89E-13 | 2.89E-13 |
| PD106 | 1.74E-14 | 1.74E-14 | 1.74E-14 | 1.74E-14 | 1.74E-14 | 1.74E-14 | 1.74E-14 | 1.74E-14 | 1.74E-14 |
| PD107 | 1.20E-17 | 1.20E-17 | 1.20E-17 | 1.20E-17 | 1.20E-17 | 1.20E-17 | 1.20E-17 | 1.20E-17 | 1.20E-17 |
| TM172 | 5.79E-15 | 4.46E-15 | 3.43E-15 | 4.24E-16 | 2.26E-18 | 3.46E-25 | 9.89E-30 | 2.07E-35 | 0.00E+00 |
| TM173 | 6.46E-16 | 8.58E-17 | 1.14E-17 | 1.10E-24 | 3.15E-42 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| YB172 | 1.43E-13 | 1.44E-13 | 1.45E-13 | 1.48E-13 | 1.49E-13 | 1.49E-13 | 1.49E-13 | 1.49E-13 | 1.49E-13 |
| YB173 | 8.91E-14 | 8.97E-14 | 8.98E-14 | 8.98E-14 | 8.98E-14 | 8.98E-14 | 8.98E-14 | 8.98E-14 | 8.98E-14 |
| YB174 | 3.70E-15 | 3.70E-15 | 3.70E-15 | 3.70E-15 | 3.70E-15 | 3.70E-15 | 3.70E-15 | 3.70E-15 | 3.70E-15 |
| YB175 | 1.10E-17 | 9.31E-18 | 7.89E-18 | 2.10E-18 | 7.68E-20 | 3.75E-24 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| LU175 | 3.40E-06 | 3.42E-06 | 3.44E-06 | 3.57E-06 | 3.87E-06 | 4.47E-06 | 4.71E-06 | 4.91E-06 | 5.16E-06 |
| LU176 | 8.97E-08 | 8.97E-08 | 8.97E-08 | 8.97E-08 | 8.97E-08 | 8.97E-08 | 8.97E-08 | 8.97E-08 | 8.97E-08 |
| LU176M | 1.02E-09 | 1.12E-11 | 1.24E-13 | 2.69E-29 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| LU177 | 1.31E-08 | 1.18E-08 | 1.06E-08 | 4.65E-09 | 5.91E-10 | 2.97E-12 | 1.50E-12 | 1.18E-12 | 5.29E-13 |
| LU177M | 2.66E-10 | 2.65E-10 | 2.64E-10 | 2.54E-10 | 2.33E-10 | 1.78E-10 | 1.49E-10 | 1.19E-10 | 5.32E-11 |
| HF174 | 6.71E-06 | 6.71E-06 | 6.71E-06 | 6.71E-06 | 6.71E-06 | 6.71E-06 | 6.71E-06 | 6.71E-06 | 6.71E-06 |
| HF175 | 1.81E-06 | 1.79E-06 | 1.77E-06 | 1.64E-06 | 1.34E-06 | 7.42E-07 | 4.99E-07 | 3.04E-07 | 5.12E-08 |
| HF176 | 3.07E-04 | 3.07E-04 | 3.07E-04 | 3.07E-04 | 3.07E-04 | 3.07E-04 | 3.07E-04 | 3.07E-04 | 3.07E-04 |
| HF177 | 1.03E-04 | 1.03E-04 | 1.03E-04 | 1.03E-04 | 1.03E-04 | 1.03E-04 | 1.03E-04 | 1.03E-04 | 1.03E-04 |
| HF178 | 1.85E-03 | 1.85E-03 | 1.85E-03 | 1.85E-03 | 1.85E-03 | 1.85E-03 | 1.85E-03 | 1.85E-03 | 1.85E-03 |
| HF178M | 3.49E-13 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| HF179 | 2.44E-03 | 2.44E-03 | 2.44E-03 | 2.44E-03 | 2.44E-03 | 2.44E-03 | 2.44E-03 | 2.44E-03 | 2.44E-03 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| HF179M | 1.57E-09 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| HF180 | 3.25E-03 | 3.25E-03 | 3.25E-03 | 3.25E-03 | 3.25E-03 | 3.25E-03 | 3.25E-03 | 3.25E-03 | 3.25E-03 |
| HF180M | 9.14E-09 | 4.44E-10 | 2.16E-11 | 6.69E-22 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| HF181 | 2.46E-05 | 2.42E-05 | 2.38E-05 | 2.09E-05 | 1.51E-05 | 5.65E-06 | 2.94E-06 | 1.30E-06 | 6.84E-08 |
| HF182 | 7.33E-07 | 7.33E-07 | 7.33E-07 | 7.33E-07 | 7.33E-07 | 7.33E-07 | 7.33E-07 | 7.33E-07 | 7.33E-07 |
| TA180 | 1.90E-04 | 1.90E-04 | 1.90E-04 | 1.90E-04 | 1.90E-04 | 1.90E-04 | 1.90E-04 | 1.90E-04 | 1.90E-04 |
| TA181 | 3.39E+00 | 3.39E+00 | 3.39E+00 | 3.39E+00 | 3.39E+00 | 3.39E+00 | 3.39E+00 | 3.39E+00 | 3.39E+00 |
| TA182 | 8.74E-02 | 8.69E-02 | 8.64E-02 | 8.23E-02 | 7.30E-02 | 5.08E-02 | 3.99E-02 | 2.96E-02 | 9.99E-03 |
| TA182M | 4.26E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TA183 | 3.65E-02 | 3.18E-02 | 2.78E-02 | 9.36E-03 | 6.18E-04 | 1.78E-07 | 7.73E-10 | 8.59E-13 | 2.04E-23 |
| W180 | 1.64E-17 | 1.65E-17 | 1.65E-17 | 1.67E-17 | 1.71E-17 | 1.85E-17 | 1.94E-17 | 2.05E-17 | 2.45E-17 |
| W182 | 1.59E-01 | 1.59E-01 | 1.60E-01 | 1.64E-01 | 1.73E-01 | 1.95E-01 | 2.06E-01 | 2.17E-01 | 2.36E-01 |
| W183M | 5.10E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| W183 | 8.57E-01 | 8.62E-01 | 8.66E-01 | 8.84E-01 | 8.93E-01 | 8.93E-01 | 8.93E-01 | 8.93E-01 | 8.93E-01 |
| W184 | 5.61E-02 | 5.61E-02 | 5.61E-02 | 5.61E-02 | 5.61E-02 | 5.61E-02 | 5.61E-02 | 5.61E-02 | 5.61E-02 |
| W185 | 8.48E-05 | 8.40E-05 | 8.33E-05 | 7.73E-05 | 6.43E-05 | 3.70E-05 | 2.56E-05 | 1.61E-05 | 3.06E-06 |
| W185M | 4.10E-12 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| W186 | 3.92E-07 | 4.01E-07 | 4.08E-07 | 4.36E-07 | 4.45E-07 | 4.45E-07 | 4.45E-07 | 4.45E-07 | 4.45E-07 |
| W187 | 6.94E-10 | 3.46E-10 | 1.73E-10 | 6.59E-13 | 5.93E-19 | 4.32E-37 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| W188 | 1.08E-10 | 1.07E-10 | 1.06E-10 | 9.81E-11 | 8.03E-11 | 4.41E-11 | 2.96E-11 | 1.80E-11 | 2.98E-12 |
| RE185 | 3.56E-05 | 3.64E-05 | 3.72E-05 | 4.31E-05 | 5.61E-05 | 8.35E-05 | 9.49E-05 | 1.04E-04 | 1.17E-04 |
| RE186 | 8.17E-07 | 6.80E-07 | 5.66E-07 | 1.30E-07 | 3.32E-09 | 5.47E-14 | 3.55E-17 | 3.67E-21 | 1.65E-35 |
| RE187 | 1.65E-08 | 1.68E-08 | 1.70E-08 | 1.72E-08 | 1.72E-08 | 1.72E-08 | 1.72E-08 | 1.72E-08 | 1.72E-08 |
| RE188 | 1.93E-11 | 8.05E-12 | 3.70E-12 | 1.01E-12 | 8.28E-13 | 4.54E-13 | 3.05E-13 | 1.85E-13 | 3.06E-14 |
| RE188M | 3.27E-13 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE189 | 4.19E-16 | 2.12E-16 | 1.07E-16 | 4.46E-19 | 5.05E-25 | 7.95E-43 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| OS186 | 5.89E-06 | 6.01E-06 | 6.12E-06 | 6.53E-06 | 6.65E-06 | 6.65E-06 | 6.65E-06 | 6.65E-06 | 6.65E-06 |
| OS188 | 5.43E-10 | 5.55E-10 | 5.61E-10 | 5.72E-10 | 5.90E-10 | 6.26E-10 | 6.41E-10 | 6.53E-10 | 6.68E-10 |
| OS189 | 3.90E-12 | 3.90E-12 | 3.90E-12 | 3.90E-12 | 3.90E-12 | 3.90E-12 | 3.90E-12 | 3.90E-12 | 3.90E-12 |
| OS190 | 1.39E-13 | 1.39E-13 | 1.39E-13 | 1.39E-13 | 1.39E-13 | 1.39E-13 | 1.39E-13 | 1.39E-13 | 1.39E-13 |
| OS191 | 2.08E-16 | 2.07E-16 | 2.00E-16 | 1.40E-16 | 5.70E-17 | 3.83E-18 | 6.33E-19 | 6.68E-20 | 2.03E-23 |
| OS191M | 1.09E-17 | 3.02E-18 | 8.40E-19 | 3.01E-23 | 2.31E-34 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| IR191 | 1.37E-16 | 1.47E-16 | 1.56E-16 | 2.17E-16 | 3.00E-16 | 3.53E-16 | 3.56E-16 | 3.57E-16 | 3.57E-16 |
| IR192 | 2.41E-17 | 2.39E-17 | 2.36E-17 | 2.19E-17 | 1.82E-17 | 1.04E-17 | 7.13E-18 | 4.46E-18 | 8.27E-19 |
| PT192 | 3.37E-18 | 3.58E-18 | 3.79E-18 | 5.42E-18 | 8.98E-18 | 1.64E-17 | 1.95E-17 | 2.21E-17 | 2.55E-17 |
| SUMTOT | 8.53E+02 | 8.53E+02 | 8.53E+02 | 8.53E+02 | 8.53E+02 | 8.53E+02 | 8.53E+02 | 8.53E+02 | 8.53E+02 |
| 0TOTAL | 8.53E+02 | 8.53E+02 | 8.53E+02 | 8.53E+02 | 8.53E+02 | 8.53E+02 | 8.53E+02 | 8.53E+02 | 8.53E+02 |

Table 24. Source Terms for 'A8 400C 3 DPA X' Capsule.

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| H 1 | 1.13E-03 | 1.13E-03 | 1.13E-03 | 1.13E-03 | 1.13E-03 | 1.13E-03 | 1.13E-03 | 1.13E-03 | 1.13E-03 |
| H 2 | 5.73E-07 | 5.73E-07 | 5.73E-07 | 5.73E-07 | 5.73E-07 | 5.73E-07 | 5.73E-07 | 5.73E-07 | 5.73E-07 |
| H 3 | 1.07E-08 | 1.07E-08 | 1.07E-08 | 1.07E-08 | 1.07E-08 | 1.06E-08 | 1.05E-08 | 1.04E-08 | 1.02E-08 |
| HE 3 | 4.55E-11 | 4.71E-11 | 4.87E-11 | 6.19E-11 | 9.48E-11 | 1.93E-10 | 2.58E-10 | 3.38E-10 | 6.23E-10 |
| HE 4 | 1.33E-02 | 1.33E-02 | 1.33E-02 | 1.33E-02 | 1.33E-02 | 1.33E-02 | 1.33E-02 | 1.33E-02 | 1.33E-02 |
| HE 6 | 9.05E-17 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| LI 6 | 2.75E-10 | 2.75E-10 | 2.75E-10 | 2.75E-10 | 2.75E-10 | 2.75E-10 | 2.75E-10 | 2.75E-10 | 2.75E-10 |
| LI 7 | 2.89E-14 | 2.89E-14 | 2.89E-14 | 2.89E-14 | 2.89E-14 | 2.89E-14 | 2.89E-14 | 2.89E-14 | 2.89E-14 |
| BE 9 | 3.24E-06 | 3.24E-06 | 3.24E-06 | 3.24E-06 | 3.24E-06 | 3.24E-06 | 3.24E-06 | 3.24E-06 | 3.24E-06 |
| BE 10 | 8.29E-08 | 8.29E-08 | 8.29E-08 | 8.29E-08 | 8.29E-08 | 8.29E-08 | 8.29E-08 | 8.29E-08 | 8.29E-08 |
| B 10 | 1.09E-14 | 1.10E-14 | 1.11E-14 | 1.19E-14 | 1.39E-14 | 1.98E-14 | 2.37E-14 | 2.86E-14 | 4.63E-14 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| B 11 | 5.46E-06 | 5.46E-06 | 5.46E-06 | 5.46E-06 | 5.46E-06 | 5.46E-06 | 5.46E-06 | 5.46E-06 | 5.46E-06 |
| C 12 | 7.60E-01 | 7.60E-01 | 7.60E-01 | 7.60E-01 | 7.60E-01 | 7.60E-01 | 7.60E-01 | 7.60E-01 | 7.60E-01 |
| C 13 | 9.25E-03 | 9.25E-03 | 9.25E-03 | 9.25E-03 | 9.25E-03 | 9.25E-03 | 9.25E-03 | 9.25E-03 | 9.25E-03 |
| C 14 | 4.80E-05 | 4.79E-05 | 4.79E-05 | 4.79E-05 | 4.79E-05 | 4.79E-05 | 4.79E-05 | 4.79E-05 | 4.79E-05 |
| N 14 | 1.81E-02 | 1.81E-02 | 1.81E-02 | 1.81E-02 | 1.81E-02 | 1.81E-02 | 1.81E-02 | 1.81E-02 | 1.81E-02 |
| N 15 | 7.33E-05 | 7.33E-05 | 7.33E-05 | 7.33E-05 | 7.33E-05 | 7.33E-05 | 7.33E-05 | 7.33E-05 | 7.33E-05 |
| O 16 | 2.49E-12 | 2.49E-12 | 2.49E-12 | 2.49E-12 | 2.49E-12 | 2.49E-12 | 2.49E-12 | 2.49E-12 | 2.49E-12 |
| O 17 | 3.78E-17 | 3.78E-17 | 3.78E-17 | 3.78E-17 | 3.78E-17 | 3.78E-17 | 3.78E-17 | 3.78E-17 | 3.78E-17 |
| O 18 | 3.82E-09 | 3.82E-09 | 3.82E-09 | 3.82E-09 | 3.82E-09 | 3.82E-09 | 3.82E-09 | 3.82E-09 | 3.82E-09 |
| F 19 | 6.47E-16 | 6.47E-16 | 6.47E-16 | 6.47E-16 | 6.47E-16 | 6.47E-16 | 6.47E-16 | 6.47E-16 | 6.47E-16 |
| NE 20 | 1.48E-12 | 1.48E-12 | 1.48E-12 | 1.48E-12 | 1.48E-12 | 1.48E-12 | 1.48E-12 | 1.48E-12 | 1.48E-12 |
| NE 21 | 4.42E-06 | 4.42E-06 | 4.42E-06 | 4.42E-06 | 4.42E-06 | 4.42E-06 | 4.42E-06 | 4.42E-06 | 4.42E-06 |
| NE 22 | 6.65E-06 | 6.65E-06 | 6.65E-06 | 6.65E-06 | 6.65E-06 | 6.65E-06 | 6.65E-06 | 6.65E-06 | 6.65E-06 |
| NE 23 | 4.66E-12 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NA 23 | 1.35E-06 | 1.35E-06 | 1.35E-06 | 1.35E-06 | 1.35E-06 | 1.35E-06 | 1.35E-06 | 1.35E-06 | 1.35E-06 |
| NA 24 | 1.74E-06 | 5.72E-07 | 1.89E-07 | 2.65E-11 | 6.17E-21 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NA 25 | 4.89E-12 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MG 24 | 7.52E-01 | 7.52E-01 | 7.52E-01 | 7.52E-01 | 7.52E-01 | 7.52E-01 | 7.52E-01 | 7.52E-01 | 7.52E-01 |
| MG 25 | 9.91E-02 | 9.91E-02 | 9.91E-02 | 9.91E-02 | 9.91E-02 | 9.91E-02 | 9.91E-02 | 9.91E-02 | 9.91E-02 |
| MG 26 | 1.14E-01 | 1.14E-01 | 1.14E-01 | 1.14E-01 | 1.14E-01 | 1.14E-01 | 1.14E-01 | 1.14E-01 | 1.14E-01 |
| MG 27 | 9.72E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MG 28 | 3.78E-14 | 1.71E-14 | 7.71E-15 | 1.33E-17 | 1.63E-24 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AL 27 | 1.33E+02 | 1.33E+02 | 1.33E+02 | 1.33E+02 | 1.33E+02 | 1.33E+02 | 1.33E+02 | 1.33E+02 | 1.33E+02 |
| AL 28 | 5.71E-07 | 3.05E-17 | 1.38E-17 | 2.38E-20 | 2.92E-27 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AL 29 | 3.52E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AL 30 | 3.32E-16 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| SI 28 | 1.57E+00 | 1.57E+00 | 1.57E+00 | 1.57E+00 | 1.57E+00 | 1.57E+00 | 1.57E+00 | 1.57E+00 | 1.57E+00 |
| SI 29 | 8.02E-02 | 8.02E-02 | 8.02E-02 | 8.02E-02 | 8.02E-02 | 8.02E-02 | 8.02E-02 | 8.02E-02 | 8.02E-02 |
| SI 30 | 5.48E-02 | 5.48E-02 | 5.48E-02 | 5.48E-02 | 5.48E-02 | 5.48E-02 | 5.48E-02 | 5.48E-02 | 5.48E-02 |
| SI 31 | 9.95E-09 | 1.75E-11 | 3.05E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SI 32 | 6.36E-12 | 6.36E-12 | 6.36E-12 | 6.36E-12 | 6.36E-12 | 6.36E-12 | 6.36E-12 | 6.36E-12 | 6.35E-12 |
| P 31 | 1.47E-02 | 1.47E-02 | 1.47E-02 | 1.47E-02 | 1.47E-02 | 1.47E-02 | 1.47E-02 | 1.47E-02 | 1.47E-02 |
| P 32 | 1.00E-06 | 9.54E-07 | 9.08E-07 | 6.16E-07 | 2.34E-07 | 1.28E-08 | 1.84E-09 | 1.63E-10 | 2.68E-14 |
| P 33 | 8.40E-11 | 8.17E-11 | 7.94E-11 | 6.36E-11 | 3.65E-11 | 6.92E-12 | 2.28E-12 | 5.71E-13 | 3.88E-15 |
| P 34 | 3.10E-15 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| S 32 | 2.03E-02 | 2.03E-02 | 2.03E-02 | 2.03E-02 | 2.03E-02 | 2.03E-02 | 2.03E-02 | 2.03E-02 | 2.03E-02 |
| S 33 | 1.81E-04 | 1.81E-04 | 1.81E-04 | 1.81E-04 | 1.81E-04 | 1.81E-04 | 1.81E-04 | 1.81E-04 | 1.81E-04 |
| S 34 | 9.58E-04 | 9.58E-04 | 9.58E-04 | 9.58E-04 | 9.58E-04 | 9.58E-04 | 9.58E-04 | 9.58E-04 | 9.58E-04 |
| S 35 | 1.32E-07 | 1.31E-07 | 1.30E-07 | 1.22E-07 | 1.04E-07 | 6.48E-08 | 4.73E-08 | 3.19E-08 | 7.73E-09 |
| S 36 | 4.09E-06 | 4.09E-06 | 4.09E-06 | 4.09E-06 | 4.09E-06 | 4.09E-06 | 4.09E-06 | 4.09E-06 | 4.09E-06 |
| S 37 | 2.39E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CL 35 | 1.82E-07 | 1.83E-07 | 1.84E-07 | 1.92E-07 | 2.09E-07 | 2.49E-07 | 2.66E-07 | 2.81E-07 | 3.06E-07 |
| CL 36 | 5.10E-09 | 5.10E-09 | 5.10E-09 | 5.10E-09 | 5.10E-09 | 5.10E-09 | 5.10E-09 | 5.10E-09 | 5.10E-09 |
| CL 37 | 8.70E-10 | 8.70E-10 | 8.70E-10 | 8.70E-10 | 8.70E-10 | 8.70E-10 | 8.70E-10 | 8.70E-10 | 8.70E-10 |
| CL 38 | 1.14E-16 | 2.57E-28 | 5.79E-40 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AR 36 | 2.31E-15 | 2.35E-15 | 2.38E-15 | 2.63E-15 | 3.26E-15 | 5.15E-15 | 6.42E-15 | 7.99E-15 | 1.37E-14 |
| AR 38 | 2.72E-13 | 2.72E-13 | 2.72E-13 | 2.72E-13 | 2.72E-13 | 2.72E-13 | 2.72E-13 | 2.72E-13 | 2.72E-13 |
| AR 39 | 8.36E-17 | 8.36E-17 | 8.36E-17 | 8.35E-17 | 8.35E-17 | 8.35E-17 | 8.35E-17 | 8.34E-17 | 8.33E-17 |
| AR 40 | 1.48E-12 | 1.48E-12 | 1.48E-12 | 1.48E-12 | 1.48E-12 | 1.48E-12 | 1.48E-12 | 1.48E-12 | 1.48E-12 |
| AR 41 | 5.90E-17 | 6.55E-21 | 7.27E-25 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| K 41 | 4.81E-14 | 4.82E-14 | 4.82E-14 | 4.82E-14 | 4.82E-14 | 4.82E-14 | 4.82E-14 | 4.82E-14 | 4.82E-14 |
| K 43 | 9.70E-15 | 4.65E-15 | 2.23E-15 | 6.16E-18 | 2.49E-24 | 1.81E-43 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| K 44 | 2.86E-17 | 5.66E-37 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CA 42 | 4.62E-16 | 4.66E-16 | 4.66E-16 | 4.67E-16 | 4.67E-16 | 4.67E-16 | 4.67E-16 | 4.67E-16 | 4.67E-16 |
| CA 43 | 8.46E-08 | 8.46E-08 | 8.46E-08 | 8.46E-08 | 8.46E-08 | 8.46E-08 | 8.46E-08 | 8.46E-08 | 8.46E-08 |
| CA 44 | 6.53E-07 | 6.53E-07 | 6.53E-07 | 6.53E-07 | 6.53E-07 | 6.53E-07 | 6.53E-07 | 6.53E-07 | 6.53E-07 |
| CA 45 | 7.77E-09 | 7.73E-09 | 7.70E-09 | 7.44E-09 | 6.84E-09 | 5.30E-09 | 4.47E-09 | 3.61E-09 | 1.68E-09 |
| CA 46 | 7.79E-08 | 7.79E-08 | 7.79E-08 | 7.79E-08 | 7.79E-08 | 7.79E-08 | 7.79E-08 | 7.79E-08 | 7.79E-08 |
| CA 47 | 4.04E-12 | 3.47E-12 | 2.97E-12 | 8.76E-13 | 4.12E-14 | 4.30E-18 | 9.53E-21 | 4.58E-24 | 5.18E-36 |
| SC 45 | 5.81E-09 | 5.84E-09 | 5.87E-09 | 6.13E-09 | 6.74E-09 | 8.28E-09 | 9.11E-09 | 9.96E-09 | 1.19E-08 |
| SC 46 | 7.08E-07 | 7.02E-07 | 6.96E-07 | 6.52E-07 | 5.52E-07 | 3.36E-07 | 2.42E-07 | 1.60E-07 | 3.60E-08 |
| SC 46M | 1.32E-16 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SC 47 | 7.50E-08 | 6.10E-08 | 4.96E-08 | 9.48E-09 | 1.51E-10 | 6.28E-16 | 1.87E-19 | 1.81E-23 | 1.46E-35 |
| SC 48 | 3.94E-09 | 2.70E-09 | 1.84E-09 | 8.83E-11 | 4.44E-14 | 5.65E-24 | 1.43E-30 | 8.10E-39 | 0.00E+00 |
| SC 49 | 8.05E-11 | 2.33E-18 | 6.73E-26 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SC 50 | 4.52E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TI 46 | 3.07E-02 | 3.07E-02 | 3.07E-02 | 3.07E-02 | 3.07E-02 | 3.07E-02 | 3.07E-02 | 3.07E-02 | 3.07E-02 |
| TI 47 | 2.83E-02 | 2.83E-02 | 2.83E-02 | 2.83E-02 | 2.83E-02 | 2.83E-02 | 2.83E-02 | 2.83E-02 | 2.83E-02 |
| TI 48 | 2.83E-01 | 2.83E-01 | 2.83E-01 | 2.83E-01 | 2.83E-01 | 2.83E-01 | 2.83E-01 | 2.83E-01 | 2.83E-01 |
| TI 49 | 2.44E-02 | 2.44E-02 | 2.44E-02 | 2.44E-02 | 2.44E-02 | 2.44E-02 | 2.44E-02 | 2.44E-02 | 2.44E-02 |
| TI 50 | 2.13E-02 | 2.13E-02 | 2.13E-02 | 2.13E-02 | 2.13E-02 | 2.13E-02 | 2.13E-02 | 2.13E-02 | 2.13E-02 |
| TI 51 | 2.04E-10 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| V 50 | 9.09E-04 | 9.09E-04 | 9.09E-04 | 9.09E-04 | 9.09E-04 | 9.09E-04 | 9.09E-04 | 9.09E-04 | 9.09E-04 |
| V 51 | 2.27E-01 | 2.27E-01 | 2.28E-01 | 2.32E-01 | 2.40E-01 | 2.49E-01 | 2.50E-01 | 2.51E-01 | 2.51E-01 |
| V 52 | 4.97E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| V 53 | 5.64E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| V 54 | 3.54E-13 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CR 50 | 5.89E+00 | 5.89E+00 | 5.89E+00 | 5.89E+00 | 5.89E+00 | 5.89E+00 | 5.89E+00 | 5.89E+00 | 5.89E+00 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| CR 51 | 2.47E-02 | 2.41E-02 | 2.35E-02 | 1.92E-02 | 1.17E-02 | 2.60E-03 | 9.56E-04 | 2.74E-04 | 3.03E-06 |
| CR 52 | 1.20E+02 | 1.20E+02 | 1.20E+02 | 1.20E+02 | 1.20E+02 | 1.20E+02 | 1.20E+02 | 1.20E+02 | 1.20E+02 |
| CR 53 | 1.42E+01 | 1.42E+01 | 1.42E+01 | 1.42E+01 | 1.42E+01 | 1.42E+01 | 1.42E+01 | 1.42E+01 | 1.42E+01 |
| CR 54 | 3.88E+00 | 3.88E+00 | 3.88E+00 | 3.88E+00 | 3.88E+00 | 3.88E+00 | 3.88E+00 | 3.88E+00 | 3.88E+00 |
| CR 55 | 3.84E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MN 54 | 4.09E-03 | 4.08E-03 | 4.07E-03 | 4.00E-03 | 3.83E-03 | 3.35E-03 | 3.07E-03 | 2.74E-03 | 1.84E-03 |
| MN 55 | 1.65E+00 | 1.65E+00 | 1.65E+00 | 1.65E+00 | 1.65E+00 | 1.65E+00 | 1.65E+00 | 1.65E+00 | 1.66E+00 |
| MN 56 | 4.00E-05 | 6.31E-08 | 9.96E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MN 57 | 1.43E-10 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MN 58 | 2.95E-13 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FE 54 | 1.94E+01 | 1.94E+01 | 1.94E+01 | 1.94E+01 | 1.94E+01 | 1.94E+01 | 1.94E+01 | 1.94E+01 | 1.94E+01 |
| FE 55 | 5.67E-02 | 5.66E-02 | 5.66E-02 | 5.63E-02 | 5.55E-02 | 5.31E-02 | 5.16E-02 | 4.97E-02 | 4.36E-02 |
| FE 56 | 3.18E+02 | 3.18E+02 | 3.18E+02 | 3.18E+02 | 3.18E+02 | 3.18E+02 | 3.18E+02 | 3.18E+02 | 3.18E+02 |
| FE 57 | 8.85E+00 | 8.85E+00 | 8.85E+00 | 8.85E+00 | 8.85E+00 | 8.85E+00 | 8.85E+00 | 8.85E+00 | 8.85E+00 |
| FE 58 | 1.09E+00 | 1.09E+00 | 1.09E+00 | 1.09E+00 | 1.09E+00 | 1.09E+00 | 1.09E+00 | 1.09E+00 | 1.09E+00 |
| FE 59 | 5.34E-04 | 5.26E-04 | 5.18E-04 | 4.58E-04 | 3.36E-04 | 1.34E-04 | 7.21E-05 | 3.34E-05 | 2.09E-06 |
| CO 58 | 6.60E-03 | 6.54E-03 | 6.47E-03 | 5.99E-03 | 4.92E-03 | 2.73E-03 | 1.85E-03 | 1.13E-03 | 1.94E-04 |
| CO 59 | 1.47E+00 | 1.47E+00 | 1.47E+00 | 1.47E+00 | 1.47E+00 | 1.47E+00 | 1.47E+00 | 1.47E+00 | 1.47E+00 |
| CO 60 | 1.02E-01 | 1.02E-01 | 1.02E-01 | 1.02E-01 | 1.01E-01 | 9.92E-02 | 9.78E-02 | 9.60E-02 | 9.00E-02 |
| CO 60M | 3.33E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CO 61 | 2.36E-07 | 9.87E-12 | 4.13E-16 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CO 62 | 3.21E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NI 58 | 1.45E+02 | 1.45E+02 | 1.45E+02 | 1.45E+02 | 1.45E+02 | 1.45E+02 | 1.45E+02 | 1.45E+02 | 1.45E+02 |
| NI 59 | 9.65E-01 | 9.65E-01 | 9.65E-01 | 9.65E-01 | 9.65E-01 | 9.65E-01 | 9.65E-01 | 9.65E-01 | 9.65E-01 |
| NI 60 | 5.75E+01 | 5.75E+01 | 5.75E+01 | 5.75E+01 | 5.75E+01 | 5.75E+01 | 5.76E+01 | 5.76E+01 | 5.76E+01 |
| NI 61 | 2.76E+00 | 2.76E+00 | 2.76E+00 | 2.76E+00 | 2.76E+00 | 2.76E+00 | 2.76E+00 | 2.76E+00 | 2.76E+00 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| NI 62 | 8.05E+00 | 8.05E+00 | 8.05E+00 | 8.05E+00 | 8.05E+00 | 8.05E+00 | 8.05E+00 | 8.05E+00 | 8.05E+00 |
| NI 63 | 1.56E-01 | 1.56E-01 | 1.56E-01 | 1.56E-01 | 1.56E-01 | 1.56E-01 | 1.56E-01 | 1.55E-01 | 1.55E-01 |
| NI 64 | 2.15E+00 | 2.15E+00 | 2.15E+00 | 2.15E+00 | 2.15E+00 | 2.15E+00 | 2.15E+00 | 2.15E+00 | 2.15E+00 |
| NI 65 | 3.96E-06 | 5.36E-09 | 7.24E-12 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NI 66 | 2.39E-09 | 1.76E-09 | 1.30E-09 | 1.14E-10 | 2.57E-13 | 2.96E-21 | 1.51E-26 | 3.67E-33 | 0.00E+00 |
| CU 63 | 7.98E-01 | 7.98E-01 | 7.98E-01 | 7.98E-01 | 7.99E-01 | 7.99E-01 | 7.99E-01 | 7.99E-01 | 8.00E-01 |
| CU 64 | 2.44E-05 | 6.57E-06 | 1.77E-06 | 4.99E-11 | 2.09E-22 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CU 65 | 3.72E-01 | 3.72E-01 | 3.72E-01 | 3.72E-01 | 3.72E-01 | 3.72E-01 | 3.72E-01 | 3.72E-01 | 3.72E-01 |
| CU 66 | 3.68E-08 | 2.75E-12 | 2.03E-12 | 1.77E-13 | 4.01E-16 | 4.62E-24 | 2.36E-29 | 5.73E-36 | 0.00E+00 |
| CU 67 | 1.40E-10 | 1.07E-10 | 8.17E-11 | 9.50E-12 | 4.39E-14 | 4.31E-21 | 9.19E-26 | 1.33E-31 | 0.00E+00 |
| ZN 64 | 2.14E-03 | 2.14E-03 | 2.14E-03 | 2.14E-03 | 2.14E-03 | 2.14E-03 | 2.14E-03 | 2.14E-03 | 2.14E-03 |
| ZN 65 | 1.23E-06 | 1.23E-06 | 1.22E-06 | 1.19E-06 | 1.13E-06 | 9.51E-07 | 8.49E-07 | 7.36E-07 | 4.42E-07 |
| ZN 66 | 1.29E-03 | 1.29E-03 | 1.29E-03 | 1.29E-03 | 1.29E-03 | 1.29E-03 | 1.29E-03 | 1.29E-03 | 1.29E-03 |
| ZN 67 | 8.48E-07 | 8.48E-07 | 8.48E-07 | 8.48E-07 | 8.48E-07 | 8.48E-07 | 8.48E-07 | 8.48E-07 | 8.48E-07 |
| ZN 68 | 4.42E-09 | 4.42E-09 | 4.42E-09 | 4.42E-09 | 4.42E-09 | 4.42E-09 | 4.42E-09 | 4.42E-09 | 4.42E-09 |
| ZN 69 | 3.49E-15 | 7.51E-17 | 2.24E-17 | 1.42E-21 | 4.47E-32 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| ZN 69M | 3.40E-15 | 1.01E-15 | 3.03E-16 | 1.91E-20 | 6.03E-31 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| GA 69 | 2.76E-12 | 2.76E-12 | 2.76E-12 | 2.76E-12 | 2.76E-12 | 2.76E-12 | 2.76E-12 | 2.76E-12 | 2.76E-12 |
| GE 70 | 4.26E-15 | 4.27E-15 | 4.27E-15 | 4.27E-15 | 4.27E-15 | 4.27E-15 | 4.27E-15 | 4.27E-15 | 4.27E-15 |
| SR 87 | 6.89E-15 | 6.89E-15 | 6.89E-15 | 6.89E-15 | 6.89E-15 | 6.89E-15 | 6.89E-15 | 6.89E-15 | 6.89E-15 |
| SR 88 | 8.81E-12 | 8.81E-12 | 8.81E-12 | 8.81E-12 | 8.81E-12 | 8.81E-12 | 8.81E-12 | 8.81E-12 | 8.81E-12 |
| SR 89 | 4.61E-12 | 4.55E-12 | 4.49E-12 | 4.02E-12 | 3.06E-12 | 1.34E-12 | 7.75E-13 | 3.90E-13 | 3.30E-14 |
| SR 90 | 1.20E-12 | 1.20E-12 | 1.20E-12 | 1.20E-12 | 1.20E-12 | 1.20E-12 | 1.19E-12 | 1.19E-12 | 1.18E-12 |
| SR 91 | 1.12E-15 | 1.94E-16 | 3.37E-17 | 2.78E-23 | 1.72E-38 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 89 | 1.94E-07 | 1.95E-07 | 1.96E-07 | 1.98E-07 | 1.99E-07 | 1.99E-07 | 1.99E-07 | 1.99E-07 | 1.99E-07 |
| Y 89M | 2.96E-13 | 2.39E-13 | 1.94E-13 | 3.55E-14 | 5.10E-16 | 1.52E-21 | 3.15E-25 | 7.81E-30 | 0.00E+00 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| Y 90 | 1.95E-08 | 1.50E-08 | 1.16E-08 | 1.45E-09 | 8.00E-12 | 3.01E-16 | 2.99E-16 | 2.98E-16 | 2.95E-16 |
| Y 90M | 2.96E-16 | 1.39E-18 | 6.47E-21 | 1.47E-39 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 91 | 3.86E-11 | 3.82E-11 | 3.77E-11 | 3.43E-11 | 2.71E-11 | 1.33E-11 | 8.28E-12 | 4.58E-12 | 5.43E-13 |
| Y 92 | 5.36E-14 | 4.87E-16 | 4.43E-18 | 2.06E-34 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Y 94 | 2.76E-17 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| ZR 89 | 5.21E-09 | 4.21E-09 | 3.41E-09 | 6.25E-10 | 8.99E-12 | 2.68E-17 | 5.54E-21 | 1.38E-25 | 3.62E-42 |
| ZR 90 | 8.96E-07 | 9.00E-07 | 9.04E-07 | 9.14E-07 | 9.15E-07 | 9.15E-07 | 9.15E-07 | 9.15E-07 | 9.15E-07 |
| ZR 91 | 2.71E-06 | 2.71E-06 | 2.71E-06 | 2.71E-06 | 2.71E-06 | 2.71E-06 | 2.71E-06 | 2.71E-06 | 2.71E-06 |
| ZR 92 | 6.31E-05 | 6.33E-05 | 6.35E-05 | 6.48E-05 | 6.60E-05 | 6.64E-05 | 6.64E-05 | 6.64E-05 | 6.64E-05 |
| ZR 93 | 1.12E-05 | 1.12E-05 | 1.12E-05 | 1.12E-05 | 1.12E-05 | 1.12E-05 | 1.12E-05 | 1.12E-05 | 1.12E-05 |
| ZR 94 | 5.80E-06 | 5.80E-06 | 5.80E-06 | 5.80E-06 | 5.80E-06 | 5.80E-06 | 5.80E-06 | 5.80E-06 | 5.80E-06 |
| ZR 95 | 2.52E-07 | 2.49E-07 | 2.46E-07 | 2.26E-07 | 1.82E-07 | 9.49E-08 | 6.15E-08 | 3.58E-08 | 5.09E-09 |
| ZR 96 | 4.73E-10 | 4.73E-10 | 4.73E-10 | 4.73E-10 | 4.73E-10 | 4.73E-10 | 4.73E-10 | 4.73E-10 | 4.73E-10 |
| ZR 97 | 9.66E-11 | 3.61E-11 | 1.35E-11 | 5.13E-15 | 1.45E-23 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 92 | 3.28E-06 | 3.07E-06 | 2.87E-06 | 1.66E-06 | 4.24E-07 | 7.08E-09 | 4.62E-10 | 1.53E-11 | 7.08E-17 |
| NB 93 | 3.47E+00 | 3.47E+00 | 3.47E+00 | 3.47E+00 | 3.47E+00 | 3.47E+00 | 3.47E+00 | 3.47E+00 | 3.47E+00 |
| NB 93M | 2.24E-12 | 2.26E-12 | 2.27E-12 | 2.37E-12 | 2.63E-12 | 3.39E-12 | 3.90E-12 | 4.52E-12 | 6.75E-12 |
| NB 94 | 2.05E-02 | 2.05E-02 | 2.05E-02 | 2.05E-02 | 2.05E-02 | 2.05E-02 | 2.05E-02 | 2.05E-02 | 2.05E-02 |
| NB 95 | 2.42E-04 | 2.38E-04 | 2.33E-04 | 1.99E-04 | 1.34E-04 | 4.12E-05 | 1.87E-05 | 7.00E-06 | 2.06E-07 |
| NB 95M | 1.01E-10 | 1.01E-10 | 1.00E-10 | 9.38E-11 | 7.60E-11 | 3.97E-11 | 2.58E-11 | 1.50E-11 | 2.13E-12 |
| NB 96 | 3.59E-08 | 1.76E-08 | 8.62E-09 | 2.88E-11 | 1.87E-17 | 5.10E-36 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 97 | 2.44E-10 | 2.58E-12 | 9.64E-13 | 3.93E-16 | 1.11E-24 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 97M | 9.02E-14 | 3.37E-14 | 1.26E-14 | 4.79E-18 | 1.35E-26 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB 98 | 2.38E-14 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NB100 | 1.03E-15 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MO 92 | 1.47E+00 | 1.47E+00 | 1.47E+00 | 1.47E+00 | 1.47E+00 | 1.47E+00 | 1.47E+00 | 1.47E+00 | 1.47E+00 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| MO 93M | 2.75E-08 | 2.42E-09 | 2.14E-10 | 7.79E-19 | 6.28E-40 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MO 93 | 3.70E-04 | 3.70E-04 | 3.70E-04 | 3.70E-04 | 3.70E-04 | 3.70E-04 | 3.70E-04 | 3.70E-04 | 3.70E-04 |
| MO 94 | 9.46E-01 | 9.46E-01 | 9.46E-01 | 9.46E-01 | 9.46E-01 | 9.46E-01 | 9.46E-01 | 9.46E-01 | 9.46E-01 |
| MO 95 | 1.54E+00 | 1.54E+00 | 1.54E+00 | 1.54E+00 | 1.54E+00 | 1.54E+00 | 1.54E+00 | 1.54E+00 | 1.54E+00 |
| MO 96 | 1.82E+00 | 1.82E+00 | 1.82E+00 | 1.82E+00 | 1.82E+00 | 1.82E+00 | 1.82E+00 | 1.82E+00 | 1.82E+00 |
| MO 97 | 1.02E+00 | 1.02E+00 | 1.02E+00 | 1.02E+00 | 1.02E+00 | 1.02E+00 | 1.02E+00 | 1.02E+00 | 1.02E+00 |
| MO 98 | 2.56E+00 | 2.56E+00 | 2.56E+00 | 2.56E+00 | 2.56E+00 | 2.56E+00 | 2.56E+00 | 2.56E+00 | 2.56E+00 |
| MO 99 | 1.97E-04 | 1.53E-04 | 1.19E-04 | 1.59E-05 | 1.03E-07 | 2.77E-14 | 1.16E-18 | 3.90E-24 | 1.39E-43 |
| MO100 | 1.04E+00 | 1.04E+00 | 1.04E+00 | 1.04E+00 | 1.04E+00 | 1.04E+00 | 1.04E+00 | 1.04E+00 | 1.04E+00 |
| MO101 | 1.85E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TC 99 | 1.02E-03 | 1.03E-03 | 1.03E-03 | 1.04E-03 | 1.05E-03 | 1.05E-03 | 1.05E-03 | 1.05E-03 | 1.05E-03 |
| TC100 | 2.02E-10 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TC101 | 1.79E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RU 99 | 1.60E-09 | 1.61E-09 | 1.62E-09 | 1.69E-09 | 1.88E-09 | 2.44E-09 | 2.81E-09 | 3.28E-09 | 4.95E-09 |
| RU100 | 7.02E-05 | 7.02E-05 | 7.02E-05 | 7.02E-05 | 7.02E-05 | 7.02E-05 | 7.02E-05 | 7.02E-05 | 7.02E-05 |
| RU101 | 2.23E-03 | 2.23E-03 | 2.23E-03 | 2.23E-03 | 2.23E-03 | 2.23E-03 | 2.23E-03 | 2.23E-03 | 2.23E-03 |
| RU102 | 4.88E-05 | 4.88E-05 | 4.88E-05 | 4.88E-05 | 4.88E-05 | 4.88E-05 | 4.88E-05 | 4.88E-05 | 4.88E-05 |
| RU103 | 3.13E-08 | 3.08E-08 | 3.02E-08 | 2.62E-08 | 1.84E-08 | 6.40E-09 | 3.16E-09 | 1.31E-09 | 5.46E-11 |
| RU104 | 3.11E-10 | 3.11E-10 | 3.11E-10 | 3.11E-10 | 3.11E-10 | 3.11E-10 | 3.11E-10 | 3.11E-10 | 3.11E-10 |
| RU105 | 1.78E-15 | 4.20E-17 | 9.89E-19 | 9.43E-32 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH103 | 2.73E-09 | 2.78E-09 | 2.84E-09 | 3.23E-09 | 4.01E-09 | 5.21E-09 | 5.53E-09 | 5.71E-09 | 5.84E-09 |
| RH104 | 6.26E-15 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH104M | 2.79E-15 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RH105 | 1.13E-14 | 8.27E-15 | 5.20E-15 | 1.21E-16 | 9.89E-21 | 5.45E-33 | 3.66E-41 | 0.00E+00 | 0.00E+00 |
| RH106M | 6.04E-17 | 3.14E-20 | 1.63E-23 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| PD104 | 4.11E-10 | 4.11E-10 | 4.11E-10 | 4.11E-10 | 4.11E-10 | 4.11E-10 | 4.11E-10 | 4.11E-10 | 4.11E-10 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| PD105 | 9.65E-13 | 9.69E-13 | 9.73E-13 | 9.78E-13 | 9.78E-13 | 9.78E-13 | 9.78E-13 | 9.78E-13 | 9.78E-13 |
| PD106 | 5.90E-14 | 5.91E-14 | 5.91E-14 | 5.91E-14 | 5.91E-14 | 5.91E-14 | 5.91E-14 | 5.91E-14 | 5.91E-14 |
| PD107 | 4.10E-17 | 4.10E-17 | 4.10E-17 | 4.10E-17 | 4.10E-17 | 4.10E-17 | 4.10E-17 | 4.10E-17 | 4.10E-17 |
| TA180 | 1.83E-04 | 1.83E-04 | 1.83E-04 | 1.83E-04 | 1.83E-04 | 1.83E-04 | 1.83E-04 | 1.83E-04 | 1.83E-04 |
| TA181 | 3.28E+00 | 3.28E+00 | 3.28E+00 | 3.28E+00 | 3.28E+00 | 3.28E+00 | 3.28E+00 | 3.28E+00 | 3.28E+00 |
| TA182 | 8.47E-02 | 8.42E-02 | 8.37E-02 | 7.97E-02 | 7.07E-02 | 4.92E-02 | 3.87E-02 | 2.86E-02 | 9.67E-03 |
| TA182M | 4.16E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TA183 | 3.56E-02 | 3.10E-02 | 2.71E-02 | 9.13E-03 | 6.03E-04 | 1.73E-07 | 7.55E-10 | 8.41E-13 | 2.00E-23 |
| W180 | 1.59E-17 | 1.59E-17 | 1.59E-17 | 1.61E-17 | 1.65E-17 | 1.78E-17 | 1.87E-17 | 1.98E-17 | 2.37E-17 |
| W182 | 1.54E-01 | 1.54E-01 | 1.55E-01 | 1.59E-01 | 1.68E-01 | 1.89E-01 | 2.00E-01 | 2.10E-01 | 2.29E-01 |
| W183M | 4.98E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| W183 | 8.37E-01 | 8.42E-01 | 8.46E-01 | 8.64E-01 | 8.72E-01 | 8.73E-01 | 8.73E-01 | 8.73E-01 | 8.73E-01 |
| W184 | 5.53E-02 | 5.53E-02 | 5.53E-02 | 5.53E-02 | 5.53E-02 | 5.53E-02 | 5.53E-02 | 5.53E-02 | 5.53E-02 |
| W185 | 8.42E-05 | 8.34E-05 | 8.26E-05 | 7.67E-05 | 6.38E-05 | 3.67E-05 | 2.54E-05 | 1.60E-05 | 3.03E-06 |
| W185M | 4.07E-12 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| W186 | 3.91E-07 | 4.00E-07 | 4.08E-07 | 4.36E-07 | 4.44E-07 | 4.44E-07 | 4.44E-07 | 4.44E-07 | 4.44E-07 |
| W187 | 6.99E-10 | 3.48E-10 | 1.74E-10 | 6.63E-13 | 5.96E-19 | 4.35E-37 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| W188 | 1.10E-10 | 1.09E-10 | 1.08E-10 | 9.95E-11 | 8.15E-11 | 4.47E-11 | 3.00E-11 | 1.82E-11 | 3.02E-12 |
| RE185 | 3.53E-05 | 3.61E-05 | 3.68E-05 | 4.27E-05 | 5.57E-05 | 8.28E-05 | 9.41E-05 | 1.04E-04 | 1.16E-04 |
| RE186 | 8.16E-07 | 6.79E-07 | 5.65E-07 | 1.30E-07 | 3.31E-09 | 5.47E-14 | 3.54E-17 | 3.67E-21 | 1.65E-35 |
| RE187 | 1.66E-08 | 1.69E-08 | 1.71E-08 | 1.73E-08 | 1.73E-08 | 1.73E-08 | 1.73E-08 | 1.73E-08 | 1.73E-08 |
| RE188 | 1.96E-11 | 8.16E-12 | 3.75E-12 | 1.03E-12 | 8.39E-13 | 4.61E-13 | 3.09E-13 | 1.88E-13 | 3.11E-14 |
| RE188M | 3.31E-13 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE189 | 4.28E-16 | 2.16E-16 | 1.09E-16 | 4.56E-19 | 5.16E-25 | 7.95E-43 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| OS186 | 5.88E-06 | 6.01E-06 | 6.12E-06 | 6.52E-06 | 6.64E-06 | 6.64E-06 | 6.64E-06 | 6.64E-06 | 6.64E-06 |
| OS188 | 5.50E-10 | 5.63E-10 | 5.69E-10 | 5.80E-10 | 5.98E-10 | 6.35E-10 | 6.50E-10 | 6.62E-10 | 6.77E-10 |

| ACTIVATION PRODUCTS (grams) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ISOTOPE | EOC | 1 Day | 2 Days | 10 Days | 30 Days | 90 Days | 130 Days | 180 Days | 360 Days |
| OS189 | 3.98E-12 | 3.98E-12 | 3.98E-12 | 3.98E-12 | 3.98E-12 | 3.98E-12 | 3.98E-12 | 3.98E-12 | 3.98E-12 |
| OS190 | 1.43E-13 | 1.43E-13 | 1.43E-13 | 1.43E-13 | 1.43E-13 | 1.43E-13 | 1.43E-13 | 1.43E-13 | 1.43E-13 |
| OS191 | 2.16E-16 | 2.14E-16 | 2.07E-16 | 1.45E-16 | 5.90E-17 | 3.97E-18 | 6.56E-19 | 6.92E-20 | 2.10E-23 |
| OS191M | 1.13E-17 | 3.13E-18 | 8.71E-19 | 3.12E-23 | 2.39E-34 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| IR191 | 1.42E-16 | 1.52E-16 | 1.61E-16 | 2.24E-16 | 3.10E-16 | 3.65E-16 | 3.69E-16 | 3.69E-16 | 3.69E-16 |
| IR192 | 2.51E-17 | 2.49E-17 | 2.46E-17 | 2.29E-17 | 1.90E-17 | 1.08E-17 | 7.43E-18 | 4.65E-18 | 8.62E-19 |
| PT192 | 3.50E-18 | 3.73E-18 | 3.95E-18 | 5.64E-18 | 9.36E-18 | 1.71E-17 | 2.03E-17 | 2.30E-17 | 2.66E-17 |
| SUMTOT | 8.67E+02 | 8.67E+02 | 8.67E+02 | 8.67E+02 | 8.67E+02 | 8.67E+02 | 8.67E+02 | 8.67E+02 | 8.67E+02 |
| 0TOTAL | 8.67E+02 | 8.67E+02 | 8.67E+02 | 8.67E+02 | 8.67E+02 | 8.67E+02 | 8.67E+02 | 8.67E+02 | 8.67E+02 |

## 9. REFERENCES

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# 10. ATTACHMENT A

INTEROFFICE MEMORANDUM — Idaho National Laboratory INL

**Date:** January 15, 2020

**To:** R. R. Little, Reactor and Nuclear Safety Engineering Manager, Advanced Test Reactor Programs

**From:** Reactor Engineering, Advanced Test Reactor Programs

**Subject:** Advanced Test Reactor Power History Through Cycle 166B-1

**References:**
(a) A. V. Briscoe letter to J. L. Durney, ATR Power History Through Cycle 34C-1, June 7, 1977, AVB-9-77
(b) C. C. Swanson letter to J. L. Durney, ATR Power History Through Cycle 72A-1, February 3, 1986, CAS-05-86
(c) L. S. Loret letter to E. C. Anderson, Sr., ATR Power History Through Cycle 102B-1, February 28, 1994, LSL-11-94
(d) D. E. Hale letter to J. C. Chapman, ATR Power History Through Cycle 133B-1, August 18, 2004, DEH-05-04

Table 1 lists the Advanced Test Reactor (ATR) N-16 constrained power history data since the Beryllium VI Core Internals Changeout (CIC) Cycle 134A-1 through Cycle 166B-1.

Table 2 lists the accumulated N-16 lobe and total core exposure, as obtained from the ATR Data Acquisition System (RDAS) for Cycles 134A-1 through 166B-1.

Table 3 lists the startup and shutdown dates and times, as obtained from logbooks or Reactor Data Accuracy System (RDAS), depending on availability.

The ATR power history prior to Cycle 134A-1 is presented in references (a) through (d).

Table 1. Summary of ATR Power History by Cycle

| | Average Lobe Power (MW) | | | | | Cycle Exposure (MWd) | | | | | | Length |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NW | NE | C | SW | SE | NW | NE | C | SW | SE | Total | (EFPD) |
| 134A-1 | - | - | - | - | - | - | - | - | - | - | - | - |
| 134A-2 | - | - | - | - | - | 0.21 | 0.30 | 0.39 | 0.36 | 0.36 | 1.62 | - |
| 134B-1 | 18.0 | 18.0 | 24.5 | 23.0 | 25.0 | 452.82 | 452.24 | 615.47 | 578.48 | 628.58 | 2,727.59 | 25.10 |
| 134B-2 | 18.0 | 18.0 | 25.8 | 23.0 | 25.0 | 385.62 | 385.80 | 553.50 | 493.24 | 536.07 | 2,354.23 | 21.40 |
| 135A-1 | 18.0 | 18.0 | 29.8 | 28.1 | 35.4 | 236.16 | 235.99 | 391.07 | 368.63 | 463.98 | 1,695.83 | 13.10 |
| 135B-1 | 18.0 | 18.0 | 24.8 | 23.0 | 25.0 | 458.28 | 458.35 | 630.79 | 585.27 | 636.51 | 2,769.20 | 25.50 |
| 135B-2 | 18.0 | 18.0 | 25.2 | 23.0 | 25.0 | 405.02 | 405.70 | 567.38 | 517.82 | 562.99 | 2,458.91 | 22.50 |
| 135C-1 | 18.0 | 18.0 | 25.0 | 23.0 | 25.0 | 729.91 | 729.70 | 1,013.45 | 933.00 | 1,013.86 | 4,419.92 | 40.60 |
| 136A-1 | 18.0 | 18.0 | 24.0 | 23.0 | 23.0 | 916.18 | 916.39 | 1,218.91 | 1,169.47 | 1,170.17 | 5,391.12 | 50.90 |
| 136B-1 | 18.0 | 18.0 | 23.9 | 23.0 | 23.0 | 701.94 | 702.32 | 931.19 | 896.93 | 896.97 | 4,129.35 | 39.00 |
| 137A-1 | 18.0 | 18.0 | 24.7 | 20.0 | 25.0 | 975.35 | 974.76 | 1,336.16 | 1,083.20 | 1,353.31 | 5,722.78 | 54.10 |
| 137B-1 | 20.0 | 17.9 | 35.5 | 56.6 | 30.4 | 241.97 | 217.01 | 429.62 | 685.38 | 367.63 | 1,941.61 | 12.10 |
| 138A-1 | 18.0 | 18.0 | 23.6 | 23.0 | 25.0 | 1,046.87 | 1,047.69 | 1,370.69 | 1,336.39 | 1,453.47 | 6,255.11 | 58.10 |

Table 1. Summary of ATR Power History by Cycle

| | Average Lobe Power (MW) | | | | | Cycle Exposure (MWd) | | | | | | Length |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NW | NE | C | SW | SE | NW | NE | C | SW | SE | Total | (EFPD) |
| 138B-1 | 18.0 | 18.0 | 23.3 | 23.0 | 25.0 | 838.54 | 839.62 | 1,084.79 | 1,070.94 | 1,164.64 | 4,998.53 | 46.60 |
| 139A-1 | 18.0 | 18.0 | 23.9 | 23.0 | 25.0 | 928.73 | 929.09 | 1,231.07 | 1,186.27 | 1,289.47 | 5,564.63 | 51.60 |
| 139B-1 | 18.0 | 18.0 | 23.2 | 23.0 | 23.0 | 919.70 | 919.66 | 1,187.49 | 1,174.88 | 1,175.03 | 5,376.76 | 51.10 |
| 140A-1 | 18.0 | 18.0 | 21.8 | 23.0 | 23.0 | 836.99 | 837.18 | 1,012.89 | 1,069.69 | 1,069.39 | 4,826.14 | 46.50 |
| 140B-1 | 18.0 | 17.7 | 21.8 | 23.6 | 23.0 | 641.72 | 629.49 | 777.20 | 842.86 | 820.00 | 3,711.27 | 35.70 |
| 141A-1 | 18.0 | 18.0 | 23.4 | 23.0 | 23.0 | 583.25 | 583.08 | 756.83 | 745.05 | 745.45 | 3,413.66 | 32.40 |
| 142A-1 | 23.0 | 18.0 | 24.7 | 24.8 | 23.0 | 1,104.91 | 864.75 | 1,186.04 | 1,192.49 | 1,104.04 | 5,452.23 | 48.00 |
| 142B-1 | 23.0 | 18.0 | 25.4 | 25.4 | 25.0 | 1,196.93 | 936.68 | 1,323.41 | 1,322.45 | 1,298.70 | 6,078.17 | 52.00 |
| 143A-1/2 | 18.0 | 18.0 | 24.3 | 26.9 | 25.0 | 879.98 | 882.52 | 1,187.67 | 1,315.44 | 1,223.08 | 5,488.69 | 48.90 |
| 143B-1 | 18.0 | 18.0 | 24.9 | 27.0 | 25.1 | 1,032.06 | 1,032.58 | 1,423.53 | 1,543.74 | 1,435.01 | 6,466.92 | 57.30 |
| 144A-1 | 18.0 | 18.0 | 23.1 | 23.0 | 25.1 | 786.97 | 787.02 | 1,006.67 | 1,004.53 | 1,093.44 | 4,678.63 | 43.70 |
| 144B-1 | 18.0 | 18.1 | 22.4 | 23.0 | 23.0 | 932.25 | 933.43 | 1,155.74 | 1,190.72 | 1,190.89 | 5,403.03 | 51.70 |
| 145A-1 | 18.0 | 17.9 | 23.2 | 23.8 | 25.7 | 982.97 | 980.89 | 1,267.34 | 1,299.49 | 1,407.75 | 5,938.44 | 54.70 |
| 145B-1 | 17.8 | 17.8 | 23.0 | 24.6 | 25.8 | 1,020.46 | 1,019.96 | 1,321.43 | 1,407.79 | 1,478.25 | 6,247.89 | 57.30 |
| 146A-1 | 18.0 | 18.0 | 24.3 | 25.8 | 26.0 | 906.76 | 906.80 | 1,225.74 | 1,300.02 | 1,312.55 | 5,651.87 | 50.50 |
| 146B-1 | 23.0 | 18.0 | 26.0 | 23.0 | 26.0 | 903.68 | 707.11 | 1,021.59 | 903.85 | 1,020.96 | 4,557.19 | 39.20 |
| 147A-1 | 23.0 | 18.0 | 24.1 | 20.9 | 23.0 | 1,156.86 | 904.42 | 1,208.41 | 1,049.42 | 1,155.15 | 5,474.26 | 50.20 |
| 148A-1 | 18.0 | 18.0 | 23.6 | 22.0 | 23.0 | 855.97 | 855.75 | 1,121.43 | 1,043.79 | 1,093.64 | 4,970.58 | 47.50 |
| 148B-1 | 18.0 | 18.0 | 23.0 | 23.8 | 23.0 | 927.50 | 926.72 | 1,181.60 | 1,223.98 | 1,185.03 | 5,444.83 | 51.50 |
| 149A-1 | 18.0 | 18.0 | 24.2 | 24.0 | 23.0 | 662.45 | 662.65 | 891.28 | 883.28 | 846.80 | 3,946.46 | 36.80 |
| 149B-1 | 18.0 | 18.0 | 24.2 | 23.0 | 23.0 | 964.38 | 964.45 | 1,297.77 | 1,231.63 | 1,230.78 | 5,689.01 | 53.60 |
| 150A-1 | 18.9 | 18.0 | 30.5 | 37.5 | 35.1 | 233.41 | 221.60 | 375.93 | 462.71 | 432.58 | 1,726.23 | 12.32 |
| 150B-1 | 19.9 | 18.0 | 24.2 | 23.0 | 23.1 | 832.84 | 754.72 | 1,014.58 | 964.86 | 966.00 | 4,533.00 | 41.87 |
| 151A-1 | 18.9 | 14.2 | 22.0 | 23.6 | 23.0 | 1,058.63 | 799.95 | 1,237.01 | 1,324.39 | 1,289.04 | 5,709.02 | 56.14 |
| 151B-1/2 | 18.9 | 14.5 | 22.1 | 23.0 | 23.0 | 971.41 | 741.75 | 1,134.87 | 1,181.94 | 1,179.97 | 5,209.94 | 51.30 |
| 152A-1/6 | - | - | - | - | - | 0.30 | 0.30 | 0.50 | 0.40 | 0.50 | 2.00 | - |
| 152B-1 | 18.9 | 15.9 | 22.4 | 23.0 | 23.0 | 966.42 | 813.00 | 1,141.28 | 1,172.08 | 1,173.57 | 5,266.35 | 51.02 |
| 153B-1 | 19.7 | 19.7 | 30.8 | 35.4 | 44.0 | 265.20 | 265.35 | 414.47 | 476.12 | 591.42 | 2,012.56 | 13.45 |
| 154A-1 | 20.0 | 16.0 | 20.5 | 20.5 | 23.0 | 1,048.12 | 838.60 | 1,069.38 | 1,071.42 | 1,204.22 | 5,231.74 | 52.28 |
| 154B-1 | 20.0 | 17.9 | 21.6 | 22.8 | 23.9 | 1,066.60 | 958.47 | 1,156.40 | 1,220.49 | 1,275.27 | 5,677.23 | 53.44 |
| 155A-1 | 17.5 | 18.0 | 21.2 | 24.9 | 23.0 | 964.46 | 992.05 | 1,169.64 | 1,373.15 | 1,269.33 | 5,768.63 | 55.14 |
| 155B-1 | 18.0 | 18.7 | 22.0 | 22.9 | 23.0 | 896.41 | 933.78 | 1,097.45 | 1,145.28 | 1,146.21 | 5,219.13 | 49.92 |
| 156A-1 | 18.0 | 18.1 | 34.4 | 47.6 | 47.3 | 258.99 | 260.10 | 495.95 | 685.85 | 681.77 | 2,382.66 | 14.40 |
| 157A-1 | 18.0 | 16.9 | 20.1 | 19.9 | 24.0 | 674.80 | 636.93 | 755.89 | 749.37 | 900.30 | 3,717.29 | 37.58 |
| 157C-1 | 18.0 | 17.0 | 21.1 | 20.1 | 25.0 | 96.61 | 91.47 | 113.15 | 107.90 | 134.07 | 543.20 | 5.37 |
| 157D-1 | 18.0 | 17.0 | 21.6 | 20.9 | 25.0 | 1,072.06 | 1,012.51 | 1,288.16 | 1,247.14 | 1,490.31 | 6,110.18 | 59.71 |
| 158A-1 | 18.0 | 19.0 | 21.3 | 20.0 | 27.0 | 941.32 | 994.16 | 1,112.08 | 1,044.16 | 1,410.05 | 5,501.77 | 52.23 |
| 158B-1 | 18.0 | 19.0 | 19.0 | 22.7 | 23.0 | 924.85 | 977.00 | 974.33 | 1,165.25 | 1,183.34 | 5,224.77 | 51.36 |
| 159A-1 | 22.1 | 22.9 | 29.1 | 37.4 | 35.0 | 68.55 | 71.08 | 90.14 | 116.01 | 108.61 | 454.39 | 3.10 |
| 160A-1 | 17.5 | 21.1 | 19.8 | 20.0 | 26.1 | 924.07 | 1,115.94 | 1,050.71 | 1,057.87 | 1,380.71 | 5,529.30 | 52.94 |
| 160B-1 | 18.0 | 21.0 | 20.9 | 23.0 | 25.6 | 1,080.05 | 1,259.85 | 1,252.55 | 1,380.11 | 1,537.65 | 6,510.21 | 60.06 |
| 161A-1 | 18.0 | 20.9 | 30.6 | 42.7 | 41.5 | 230.21 | 268.17 | 392.91 | 547.87 | 532.53 | 1,971.69 | 12.82 |
| 162A-1 | 20.1 | 17.9 | 22.8 | 24.0 | 26.2 | 1,244.31 | 1,105.06 | 1,410.78 | 1,486.12 | 1,621.56 | 6,867.83 | 61.90 |
| 162B-1 | 20.0 | 14.5 | 19.2 | 23.9 | 23.0 | 769.04 | 560.05 | 738.98 | 918.84 | 884.90 | 3,871.81 | 38.51 |
| 163A-1 | 21.0 | 20.5 | 28.3 | 40.8 | 31.8 | 62.84 | 61.22 | 84.68 | 121.93 | 95.13 | 425.80 | 2.99 |
| 164A-1 | 20.0 | 16.0 | 19.4 | 22.4 | 25.7 | 1,099.06 | 879.28 | 1,067.84 | 1,230.00 | 1,410.51 | 5,686.69 | 54.91 |
| 164B-1 | 19.5 | 16.4 | 19.7 | 23.1 | 25.1 | 1,246.27 | 1,051.72 | 1,261.58 | 1,477.80 | 1,607.82 | 6,645.19 | 64.06 |
| 165A-1 | 18.9 | 19.2 | 30.4 | 43.6 | 32.8 | 252.25 | 256.95 | 405.95 | 582.97 | 438.65 | 1,936.77 | 13.37 |
| 166A-1/2 | 19.9 | 16.9 | 21.9 | 25.8 | 25.6 | 1,243.62 | 1,055.00 | 1,370.18 | 1,609.59 | 1,603.05 | 6,881.44 | 62.50 |

Table 1. Summary of ATR Power History by Cycle

| | Average Lobe Power (MW) | | | | | Cycle Exposure (MWd) | | | | | | Length |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NW | NE | C | SW | SE | NW | NE | C | SW | SE | Total | (EFPD) |
| 166B-1 | 19.9 | 16.9 | 22.1 | 25.9 | 25.0 | 1,221.18 | 1,034.39 | 1,355.40 | 1,586.13 | 1,528.59 | 6,725.69 | 61.23 |

Table 2. Cumulative Exposure

| | Cumulative Exposure (MWd) | | | | | |
|---|---|---|---|---|---|---|
| | NW | NE | C | SW | SE | Total |
| 134A-1 | - | - | - | - | - | - |
| 134A-2 | 0.21 | 0.30 | 0.39 | 0.36 | 0.36 | 1.62 |
| 134B-1 | 453.03 | 452.54 | 615.86 | 578.84 | 628.94 | 2,729.21 |
| 134B-2 | 838.65 | 838.34 | 1,169.36 | 1,072.08 | 1,165.01 | 5,083.44 |
| 135A-1 | 1,074.81 | 1,074.33 | 1,560.43 | 1,440.71 | 1,628.99 | 6,779.27 |
| 135B-1 | 1,533.09 | 1,532.68 | 2,191.22 | 2,025.98 | 2,265.50 | 9,548.47 |
| 135B-2 | 1,938.11 | 1,938.38 | 2,758.60 | 2,543.80 | 2,828.49 | 12,007.38 |
| 135C-1 | 2,668.02 | 2,668.08 | 3,772.05 | 3,476.80 | 3,842.35 | 16,427.30 |
| 136A-1 | 3,584.20 | 3,584.47 | 4,990.96 | 4,646.27 | 5,012.52 | 21,818.42 |
| 136B-1 | 4,286.14 | 4,286.79 | 5,922.15 | 5,543.20 | 5,909.49 | 25,947.77 |
| 137A-1 | 5,261.49 | 5,261.55 | 7,258.31 | 6,626.40 | 7,262.80 | 31,670.55 |
| 137B-1 | 5,503.46 | 5,478.56 | 7,687.93 | 7,311.78 | 7,630.43 | 33,612.16 |
| 138A-1 | 6,550.33 | 6,526.25 | 9,058.62 | 8,648.17 | 9,083.90 | 39,867.27 |
| 138B-1 | 7,388.87 | 7,365.87 | 10,143.41 | 9,719.11 | 10,248.54 | 44,865.80 |
| 139A-1 | 8,317.60 | 8,294.96 | 11,374.48 | 10,905.38 | 11,538.01 | 50,430.43 |
| 139B-1 | 9,237.30 | 9,214.62 | 12,561.97 | 12,080.26 | 12,713.04 | 55,807.19 |
| 140A-1 | 10,074.29 | 10,051.80 | 13,574.86 | 13,149.95 | 13,782.43 | 60,633.33 |
| 140B-1 | 10,716.01 | 10,681.29 | 14,352.06 | 13,992.81 | 14,602.43 | 64,344.60 |
| 141A-1 | 11,299.26 | 11,264.37 | 15,108.89 | 14,737.86 | 15,347.88 | 67,758.26 |
| 142A-1 | 12,404.17 | 12,129.12 | 16,294.93 | 15,930.35 | 16,451.92 | 73,210.49 |
| 142B-1 | 13,601.10 | 13,065.80 | 17,618.34 | 17,252.80 | 17,750.62 | 79,288.66 |
| 143A-1/2 | 14,481.08 | 13,948.32 | 18,806.01 | 18,568.24 | 18,973.70 | 84,777.35 |
| 143B-1 | 15,513.14 | 14,980.90 | 20,229.54 | 20,111.98 | 20,408.71 | 91,244.27 |
| 144A-1 | 16,300.11 | 15,767.92 | 21,236.21 | 21,116.51 | 21,502.15 | 95,922.90 |
| 144B-1 | 17,232.36 | 16,701.35 | 22,391.95 | 22,307.23 | 22,693.04 | 101,325.93 |
| 145A-1 | 18,215.33 | 17,682.24 | 23,659.29 | 23,606.72 | 24,100.79 | 107,264.37 |
| 145B-1 | 19,235.79 | 18,702.20 | 24,980.72 | 25,014.51 | 25,579.04 | 113,512.26 |
| 146A-1 | 20,142.55 | 19,609.00 | 26,206.46 | 26,314.53 | 26,891.59 | 119,164.13 |
| 146B-1 | 21,046.23 | 20,316.11 | 27,228.05 | 27,218.38 | 27,912.55 | 123,721.32 |
| 147A-1 | 22,203.09 | 21,220.53 | 28,436.46 | 28,267.80 | 29,067.70 | 129,195.58 |
| 148A-1 | 23,059.06 | 22,076.28 | 29,557.89 | 29,311.59 | 30,161.34 | 134,166.16 |
| 148B-1 | 23,986.56 | 23,003.00 | 30,739.49 | 30,535.57 | 31,346.37 | 139,610.99 |
| 149A-1 | 24,649.01 | 23,665.65 | 31,630.77 | 31,418.85 | 32,193.17 | 143,557.45 |
| 149B-1 | 25,613.39 | 24,630.10 | 32,928.54 | 32,650.48 | 33,423.95 | 149,246.46 |
| 150A-1 | 25,846.80 | 24,851.70 | 33,304.47 | 33,113.19 | 33,856.53 | 150,972.69 |
| 150B-1 | 26,679.64 | 25,606.42 | 34,319.05 | 34,078.05 | 34,822.53 | 155,505.69 |
| 151A-1 | 27,738.27 | 26,406.37 | 35,556.06 | 35,402.44 | 36,111.57 | 161,214.71 |
| 151B-1/2 | 28,709.68 | 27,148.12 | 36,690.93 | 36,584.38 | 37,291.54 | 166,424.65 |
| 152A-1/6 | 28,709.98 | 27,148.42 | 36,691.43 | 36,584.78 | 37,292.04 | 166,426.65 |
| 152B-1 | 29,676.40 | 27,961.42 | 37,832.71 | 37,756.86 | 38,465.61 | 171,693.00 |
| 153B-1 | 29,941.60 | 28,226.77 | 38,247.18 | 38,232.98 | 39,057.03 | 173,705.56 |
| 154A-1 | 30,989.72 | 29,065.37 | 39,316.56 | 39,304.40 | 40,261.25 | 178,937.30 |
| 154B-1 | 32,056.32 | 30,023.84 | 40,472.96 | 40,524.89 | 41,536.52 | 184,614.53 |

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Table 2. Cumulative Exposure

| | Cumulative Exposure (MWd) | | | | | |
|---|---|---|---|---|---|---|
| | NW | NE | C | SW | SE | Total |
| 155A-1 | 33,020.78 | 31,015.89 | 41,642.60 | 41,898.04 | 42,805.85 | 190,383.16 |
| 155B-1 | 33,917.19 | 31,949.67 | 42,740.05 | 43,043.32 | 43,952.06 | 195,602.29 |
| 156A-1 | 34,176.18 | 32,209.77 | 43,236.00 | 43,729.17 | 44,633.83 | 197,984.95 |
| 157A-1 | 34,850.98 | 32,846.70 | 43,991.89 | 44,478.54 | 45,534.13 | 201,702.24 |
| 157C-1 | 34,947.59 | 32,938.17 | 44,105.04 | 44,586.44 | 45,668.20 | 202,245.44 |
| 157D-1 | 36,019.65 | 33,950.68 | 45,393.20 | 45,833.58 | 47,158.51 | 208,355.62 |
| 158A-1 | 36,960.97 | 34,944.84 | 46,505.28 | 46,877.74 | 48,568.56 | 213,857.39 |
| 158B-1 | 37,885.82 | 35,921.84 | 47,479.61 | 48,042.99 | 49,751.90 | 219,082.16 |
| 159A-1 | 37,954.37 | 35,992.92 | 47,569.75 | 48,159.00 | 49,860.51 | 219,536.55 |
| 160A-1 | 38,878.44 | 37,108.86 | 48,620.46 | 49,216.87 | 51,241.22 | 225,065.85 |
| 160B-1 | 39,958.49 | 38,368.71 | 49,873.01 | 50,596.98 | 52,778.87 | 231,576.06 |
| 161A-1 | 40,188.70 | 38,636.88 | 50,265.92 | 51,144.85 | 53,311.40 | 233,547.75 |
| 162A-1 | 41,433.01 | 39,741.94 | 51,676.70 | 52,630.97 | 54,932.96 | 240,415.58 |
| 162B-1 | 42,202.05 | 40,301.99 | 52,415.68 | 53,549.81 | 55,817.86 | 244,287.39 |
| 163A-1 | 42,264.89 | 40,363.21 | 52,500.36 | 53,671.74 | 55,912.99 | 244,713.19 |
| 164A-1 | 43,363.95 | 41,242.49 | 53,568.20 | 54,901.74 | 57,323.5 | 250,399.88 |
| 164B-1 | 44,610.22 | 42,294.21 | 54,829.78 | 56,379.54 | 58,931.32 | 257,045.07 |
| 165A-1 | 44,862.47 | 42,551.16 | 55,235.73 | 56,962.51 | 59,369.97 | 258,981.84 |
| 166A-1/2 | 46,106.09 | 43,606.16 | 56,605.91 | 58,572.10 | 60,973.02 | 265,863.28 |
| 166B-1 | 47,327.27 | 44,640.55 | 57,961.31 | 60,158.23 | 62,501.61 | 272,588.97 |

Table 3. Startup and Shutdown Dates

| | $N_L$ | SCRAM | Xe #1 $N_L$ | SCRAM | Xe #2 $N_L$ | SCRAM | Xe #3 $N_L$ | SCRAM |
|---|---|---|---|---|---|---|---|---|
| 134B-1 | 13Apr2005 11:00 | 9May2005 14:55 | | | | | | |
| 134B-2 | 14May2005 14:52 | 5Jun2005 04:00 | | | | | | |
| 135A-1 | 26Jun2005 06:18 | 9Jul2005 19:30 | | | | | | |
| 135B-1 | 24Jul2005 18:11 | 19Aug2005 14:38 | | | | | | |
| 135B-2 | 25Aug2005 18:05 | 17Sep2005 11:30 | | | | | | |
| 135C-1 | 26Sep2005 01:44 | 5Nov2005 18:00 | | | | | | |
| 136A-1 | 24Nov2005 12:06 | 14Jan2006 12:00 | | | | | | |
| 136B-1 | 21Jan2006 20:36 | 13Feb2006 14:09 | 20Feb2006 01:37 | 9Mar2006 05:04 | | | | |
| 137A-1 | 16Apr2006 15:55 | 10Jun2006 09:00 | | | | | | |
| 137B-1 | 27Jun2006 11:08 | 9Jul2006 23:00 | | | | | | |
| 138A-1 | 12Oct2006 04:24 | 9Dec2006 14:00 | | | | | | |
| 138B-1 | 24Dec2006 16:39 | 10Feb2007 09:00 | | | | | | |
| 139A-1 | 25Feb2007 16:41 | 19Mar2007 08:00 | 22Mar2007 01:15 | 21Apr2007 09:00 | | | | |
| 139B-1 | 24Jun2007 18:22 | 26Jul2007 09:03 | 8Sep2007 22:56 | 29Sep2007 08:00 | | | | |

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Table 3. Startup and Shutdown Dates

| | $N_L$ | SCRAM | Xe #1 $N_L$ | SCRAM | Xe #2 $N_L$ | SCRAM | Xe #3 $N_L$ | SCRAM |
|---|---|---|---|---|---|---|---|---|
| 140A-1 | 15Oct2007 14:43 | 1Dec2007 08:00 | | | | | | |
| 140B-1 | 15Dec2007 15:55 | 9Jan2008 18:20 | 15Jan2008 02:08 | 26Jan2008 09:59 | | | | |
| 141A-1 | 4Feb2008 19:45 | 8Mar2008 10:00 | | | | | | |
| 142A-1 | 30Apr2008 15:25 | 1May2008 08:48 | 2May2008 02:48 | 3Jun2008 06:57 | 5Jun2008 09:26 | 21Jun2008 11:00 | | |
| 142B-1 | 4Jul2008 13:31 | 6Jul2008 00:30 | 8Jul2008 19:18 | 5Aug2008 15:00 | 7Aug2008 13:02 | 30Aug2008 21:00 | | |
| 143A-1 | 23Sep2008 13:19 | 16Oct2008 12:35 | 5Nov2008 06:44 | 21Nov2008 10:05 | | | | |
| 143A-2 | 26Nov2008 03:32 | 6Dec2008 09:06 | | | | | | |
| 143B-1 | 22Dec2008 13:41 | 19Jan2009 09:03 | 21Jan2009 02:06 | 20Feb2009 10:00 | | | | |
| 144A-1 | 12Mar2009 09:01 | 25Apr2009 09:54 | | | | | | |
| 144B-1 | 10May2009 15:51 | 31May2009 18:31 | 3Jun2009 13:00 | 4Jul2009 10:06 | | | | |
| 145A-1 | 5Sep2009 03:02 | 29Sep2009 08:32 | 1Oct2009 02:29 | 8Oct2009 01:48 | 10Oct2009 13:08 | 12Oct2009 18:09 | 15Oct2009 04:23 | 6Nov2009 05:17 |
| 145B-1 | 22Nov2009 12:16 | 1Dec2009 12:01 | 4Dec2009 08:06 | 23Jan2010 05:00 | | | | |
| 146A-1 | 7Feb2010 20:55 | 14Feb2010 13:51 | 17Feb2010 22:26 | 3Apr2010 10:00 | | | | |
| 146B-1 | 20Apr2010 20:54 | 30May2010 08:36 | | | | | | |
| 147A-1 | 22Jun2010 15:35 | 23Jul2010 05:11 | 25Jul2010 07:37 | 14Aug2010 10:05 | | | | |
| 148A-1 | 31Aug2010 18:53 | 12Oct2010 20:35 | 17Oct2010 14:32 | 23Oct2010 10:00 | | | | |
| 148B-1 | 17Nov2010 14:46 | 8Jan2011 10:00 | | | | | | |
| 149A-1 | 14Apr2011 01:27 | 21May2011 10:00 | | | | | | |
| 149B-1 | 6Jun2011 11:18 | 30Jul2011 10:00 | | | | | | |
| 150A-1 | 19Aug2011 11:42 | 1Sep2011 03:43 | | | | | | |
| 150B-1 | 15Oct2011 00:19 | 26Nov2011 10:00 | | | | | | |
| 151A-1 | 14Dec2011 00:14 | 25Dec2011 09:17 | 28Dec2011 03:50 | 11Feb2012 10:00 | | | | |
| 151B-1 | 1Mar2012 05:14 | 22Mar2012 08:07 | 25Mar2012 08:18 | 27Mar2012 14:24 | | | | |
| 151B-2 | 6Apr2012 23:09 | 5May2012 10:03 | | | | | | |
| 152A-1/6 | 15Aug2012 0800 | 20Oct2012 0459 | | | | | | |
| 152B-1 | 27Nov2012 03:39 | 18Jan2013 10:00 | | | | | | |
| 153B-1 | 29Mar2013 12:34 | 12Apr2013 18:41 | | | | | | |
| 154A-1 | 19May2013 02:36 | 21May2013 05:13 | 23May2013 19:11 | 13Jul2013 10:00 | | | | |

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Table 3. Startup and Shutdown Dates

| | $N_L$ | SCRAM | Xe #1 $N_L$ | SCRAM | Xe #2 $N_L$ | SCRAM | Xe #3 $N_L$ | SCRAM |
|---|---|---|---|---|---|---|---|---|
| 154B-1 | 23Aug2013 14:12 | 16Oct2013 10:03 | | | | | | |
| 155A-1 | 8Nov2013 00:28 | 13Nov2013 01:37 | 28Nov2013 02:10 | 17Jan2014 15:05 | | | | |
| 155B-1 | 13Feb2014 04:11 | 21Mar2014 07:19 | 28Mar2014 16:41 | 12Apr2014 04:00 | | | | |
| 156A-1 | 29May2014 04:26 | 4Jun2014 16:53 | 7Jun2014 01:02 | 7Jun2014 21:35 | 10Jun2014 13:43 | 18Jun2014 21:00 | | |
| 157A-1 | 23Jul2014 05:02 | 30Aug2014 02:42 | | | | | | |
| 157C-1 | 9Feb2015 17:21 | 15Feb2015 08:39 | | | | | | |
| 157D-1 | 29May2015 22:00 | 23Jul2015 18:01 | 6Aug2015 21:48 | 12Aug2015 04:00 | | | | |
| 158A-1 | 10Nov2015 03:21 | 2Jan2016 04:06 | | | | | | |
| 158B-1 | 9Feb2016 16:30 | 1Apr2016 09:00 | | | | | | |
| 159A-1 | 16Jun2016 22:58 | 23Jun2016 10:32 | 27Jun2016 02:09 | 28Jun2016 18:16 | | | | |
| 160A-1 | 16Sep2016 02:34 | 8Nov2016 11:00 | | | | | | |
| 160B-1 | 19Dec2016 22:07 | 18Jan2017 16:52 | 23Jan2017 19:08 | 23Feb2017 14:33 | | | | |
| 161A-1 | 29May2017 03:45 | 11Jun2017 15:41 | | | | | | |
| 162A-1 | 6Oct2017 05:03 | 7Dec2017 10:59 | | | | | | |
| 162B-1 | 16Feb2018 01:19 | 9Mar2018 17:35 | 11Mar2018 22:12 | 29Mar2018 08:06 | | | | |
| 163A-1 | 29Apr2018 11:30 | 8May2018 03:38 | | | | | | |
| 164A-1 | 10Jun2018 18:12 | 24Jun2018 06:46 | 3Jul2018 06:22 | 30Jul2018 13:13 | 2Aug2018 08:11 | 17Aug2018 15:06 | | |
| 164B-1 | 18Sep2018 21:31 | 15Oct2018 22:06 | 24Oct2018 03:10 | 4Nov2018 20:06 | 22Dec2018 05:36 | 17Jan2019 15:18 | | |
| 165A-1 | 28Feb2019 02:47 | 3Mar2019 10:53 | 7Jun2019 20:54 | 18Jun2019 16:52 | | | | |
| 166A-1/2 | 25Jul2019 01:03 | 6Sep2019 09:08 | 16Sep2019 21:28 | 6Oct2019 10:06 | | | | |
| 166B-1 | 9Nov2019 16:40 | 10Jan2020 11:30 | | | | | | |

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January 15, 2020
RE-01-20
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Cycle 166B-1 Surveillance File
Reactor Engineering Letter File (RE-01-20)

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# 11. ATTACHMENT B

**Katie A. Anderson**
Wed 1/29/2020 7:04 AM
Jason V. Brookman

Hi Jason,

The NSUF program would like to request you to perform an as-run analysis of the 3 DPA capsules for the BSU-8242 experiment and document your analysis in the form of a tech checked ECAR.

Thanks,
Katie

Idaho National Laboratory

**KATIE ANDERSON** | Experiment Manager
*Irradiation Testing*

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## 12. ATTACHMENT C

BSU-8242 Assembly - Capsul...
18 KB

Hi Jason,

Due to the capsule misload at ATR, the program is requesting an analysis of the actual configuration with an update/revision to the ECAR as needed to reflect the true irradiation conditions. Please see the attached file which documents the discovery of the swap between capsules D and E and how they were found to have been irradiated in the wrong ATR positions. Please let me know if you have any questions.

Thanks,
Katie

Idaho National Laboratory

**KATIE ANDERSON** | Experiment Manager
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# BSU-8242 Assembly/Capsule Pairing Issue & Timeline

**Issue:** On 27 May 2020, Advanced Test Reactor (ATR) Canal Operators discovered that two Boise State University experiment (BSU-8242) capsules were welded to the wrong assemblies. The assemblies have a long upper tube welded to the top of the capsule. Both the upper tube and the experiment capsule are marked with IDs. The ID on the upper tube is used for identification during reactor loading and canal handling. In preparation to ship the experiments, the upper tubes were cut off and the ID on the capsules was checked. At this point, it was discovered that nearly identical capsules from two BSU-8242 assemblies had been interchanged, resulting in a capsule swap between adjacent ATR experiment positions A7 and A8.

| Date (Time) | Event Description |
|---|---|
| April 2018 | Final assembly/welding of BSU-8242 occurred. 8242-D had a machining issue with the “D” which resulted in the “D” being re-machined. |
| 4/30/18 | Prior to welding, engineer G. Housley signs off that assembly components looked correctly arranged, however, at that point the pieces were not assembled (Step 180 in work package). Welding occurred after the engineer left. |
| 5/1/18 | Green tag(s) is(are) issued for BSU-8242 assemblies. |
| 5/20/20 | S. Evans requests confirmation of capsule and assembly IDs during cutting to ensure the correct identifiers are used for shipping (top portion of the experiment assembly is cut off prior to shipping). |
| 5/27/20 (pm) | G. Schuldt, M. Hill and ATR Canal Ops discover markings do not match between assembly and capsule IDs for BSU assemblies 8242-D and 8242-E. They proceed with cutting based on assembly identifiers and use video |

| | |
|---|---|
| | recording to ensure capsule and assembly identifiers were captured prior to cutting. |
| 5/27/20 (~3pm) | G. Schuldt calls S. Evans to report discrepancies. |
| 5/27/20 (4:30 pm) | S. Evans sends email to K. Lombard, T. Skeen, R. Marlow, M. Hill, K. Anderson, and G. Schuldt reporting discrepancy between drawings and verbal report of as-found capsule and assembly pairing. |
| 5/28/20 (am) | Upon receipt of the cutting video, T. Skeen and S. Evans independently confirm capsule and assembly IDs do not match drawings. |
| 5/28/20 (noon) | S. Evans sends an email to K. Lombard and T. Skeen with photos from video documenting swap of the capsules attached to assemblies 8242-D and 8242-E. Notification to ATR Operations management follows. |
| 5/28/20 | G. Schuldt (ATR Ops) notifies J. Duplessis (DOE)of the issue. |

**Timeline:**