Double Door Transfer Port Use to Maximize ALARA in Contained Transfer Operations

P. A. Westover and B. M. Allen
SRNL

S. D. Chunglo
La Calhène, Prescott, AZ

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The transfer of materials between gloveboxes has often been associated with increased dose or exposure.

**WHY:**
- The nature of the transfer operation, Simplicity affects the chance of dose or exposure. (KISS)

**What are the options to improve ALARA**
- How the Double Door Transfer Port (DPTÉ™) meets the needs.
ALARA Improvements in Contained Transfer

- **Nature of Operation**
  - Bag in / Bag out

  - Considerable care required
  - Normally, much Personal Protective Equipment
  - Multiple operators
  - Multiple steps
  - Considerable Process Waste Generated
  - **Operation Quality based on Operator Knowledge and Performance**
  - NOT EXACTLY SIMPLE
ALARA Improvements in Contained Transfer

- **Nature of Operation**
  - Bag in / Bag out
  - Airlock / Open Hood

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ALARA Improvements in Contained Transfer

**Nature Of Operation**
- Bag in / Bag out
- Airlock / Open Hood
- DPTE™

- Considerably Fast yet Safe
- PPE may not be required
- Few simple steps
- Single operators can perform even drum transfer
- Very little if any process waste generated
- Interlocks prevent containment breach
- **Operation Quality is consistent**
- SIMPLE AND SAFE

DPTE™ TRU Waste System
ALARA Improvements in Contained Transfer

- **Nature of Operation**

- **Methods to improve the safety and ALARA of operations**

  1. **Administrative Controls**
     - **Benefits**
       - Improved ALARA and Safety
     - **Drawbacks**
       - Made process more tedious
       - Drives good operators away from job
       - Increased training
       - Simplicity is degraded
ALARA Improvements in Contained Transfer

- Nature of Operation
- **Methods to improve the safety and ALARA of operations**

1. Administrative Controls
2. Engineered Controls
   - Benefits
     - Improved ALARA and Safety
     - Sometimes more efficient
     - Sometimes simplifies operations
   - Drawbacks
     - Sometimes less efficient
     - Sometimes more costly
     - Sometimes simplicity is degraded
ALARA Improvements in Contained Transfer

The Engineered DPTE™ Solution

- Mechanically / Electrically Interlocked
- Electrically Sensored Options
- PE or Stainless Steel Doors and Containers
- Safety Transport Covers

Designed for contained Maintainability

[I] Safety Transport Covers
ALARA Improvements in Contained Transfer

- The Engineered DPTE™ Solution for

  $\alpha / \beta$ Containment

  with $\gamma$ shielding

  [PADIRAC]

- [B] Pneumatic or Electric Actuation
- [D,E] Manipulator Maintainable

PADIRAC In Operation

Type A / B Transportainers
ALARA Improvements in Contained Transfer

- The Engineered DPTE™ Solution
  TRU Waste Handling and Packaging

- No Bags, Tapes, Ties, or Sharps padding
- Less Time Handling, Manipulating, and Disposing of Waste
- No Containment Breach
ALARA Improvements in Contained Transfer

- The Engineered DPTE™ Solution

TRU Waste Handling and Packaging
ALARA Improvements in Contained Transfer

- The Nature of the Operation
- Methods to improve the safety and ALARA of operations
  1. Administrative Controls
  2. Engineered Controls
    a) A Defined Containment Ratio (CR) can be determined for a controlled repeatable operation like the DPTE™ using surrogate material testing
    b) DPTE™ was tested with a 0.15 micron particle size uranine aerosol
      i. Multiple operations performed (connect, open-close doors, disconnect)
      ii. Containment Ratio (CR) = Contamination in E1 / Contamination in E2
         a. Worst Case Measured CR = 2.9 E06 ± 30% †
         iii. External Transferred Contamination = 1/CR * Internal DPM or Mass

Note: A 99.999% efficient HEPA filter has a Containment Ratio of 1.0 E05
† Ref: NTA 3003/58, DPTE™ Qualification report for particulate contamination, Rev. A
ALARA Improvements in Contained Transfer

1/CR * Internal Activity or Mass = External Transferred Contamination

Example:

If 1.0E08 DPM in containment, then

\[
\frac{1}{2.9 \times 10^6} \times 1.0 \times 10^8 = 3.44 \times 10^{-7} \times 1.0 \times 10^8
\]

= 34.5 ± 30% DPM outside containment †

† CR for DPTE™ was derived using worst case scenario of positive 0.5” W.C. in box and a 0.15 micron particle size surrogate
ALARA Improvements in Contained Transfer

- **Control the Nature of the Transfer Operation**
  1. Provide an operation that is Simple, Safe, Fast, Efficient, and provides consistent containment results

- **Methods to improve the safety and ALARA of operations**
  1. Administrative Controls
     a) The Shorter, the Better
  2. Engineered Controls
     a) A well engineered transfer device gives consistent containment results
     b) A Transfer Device with consistent containment results allows the use of a Containment Ratio to determine and control ALARA results.

SRNL Gloveboxes That Will Utilize the DPTE™
ALARA Improvements in Contained Transfer

CONCLUSION

– ALARA for Contained Transfer Operations is best controlled with the use of Engineered Controls to provide Simple yet consistent containment during transfer operations.

– The DPTE™ is an engineering controlled device that is Simple, very consistent, safe, efficient, and has been proven to provide a very good Containment Ratio per transfer.

– Utilization of double door transfer technology (DPTE™) in place of Bag operations and Open Hoods with Airlocks for most α, β and γ containing Material transfer, Sample transfer, and Waste transfer/packaging will greatly improve ALARA, improve operational efficiency, and minimize waste.