

# Generation of particulate matter during handling of needle and syringe packaging

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Table 2.  
Mean Particle Counts for Products Opened by All Methods (Particles/m<sup>3</sup>)<sup>a</sup>

| Method and Product                  | Probe Location          |                       |                   |                    |                     |
|-------------------------------------|-------------------------|-----------------------|-------------------|--------------------|---------------------|
|                                     | Downstream <sup>b</sup> | Upstream <sup>c</sup> | Left <sup>d</sup> | Right <sup>e</sup> | Buffer <sup>f</sup> |
| <b>Peel-and-present<sup>g</sup></b> |                         |                       |                   |                    |                     |
| Needle, 18 gauge                    |                         |                       |                   |                    |                     |
| BD 305196                           | 471                     | 0                     | 1                 | 0                  | 191                 |
| Terumo 3NN-1838R                    | 938                     | 0                     | 0                 | 3                  | 833                 |
| Tyco 1188818112                     | 520                     | 0                     | 0                 | 0                  | 359                 |
| Syringe, 1 mL                       |                         |                       |                   |                    |                     |
| BD 309628                           | 269                     | 0                     | 0                 | 3                  | 649                 |
| Tyco 1180100777                     | 6,230                   | 0                     | 0                 | 0                  | 609                 |
| Syringe, 10 or 12 mL                |                         |                       |                   |                    |                     |
| BD 309604                           | 582                     | 0                     | 0                 | 0                  | 488                 |
| Terumo 35S-10L                      | 260                     | 0                     | 0                 | 1                  | 218                 |
| Tyco 1181200777                     | 5,713                   | 2                     | 1                 | 7                  | 255                 |
| Syringe, 60 mL                      |                         |                       |                   |                    |                     |
| BD 309653                           | 174                     | 0                     | 0                 | 10                 | 223                 |
| Tyco 1186000077                     | 4,182                   | 0                     | 17                | 14                 | 282                 |
| <b>Pop-through<sup>h</sup></b>      |                         |                       |                   |                    |                     |
| Needle, 18 gauge                    |                         |                       |                   |                    |                     |
| BD 305196                           | 2,472                   | 0                     | 0                 | 0                  | 281                 |
| Terumo 3NN-1838R                    | 17,937                  | 0                     | 0                 | 0                  | 545                 |
| Syringe, 1 mL                       |                         |                       |                   |                    |                     |
| BD 309628                           | 2,397                   | 0                     | 0                 | 0                  | 403                 |
| Tyco 1180100777                     | 34,243                  | 0                     | 0                 | 0                  | 549                 |
| Syringe, 10 or 12 mL                |                         |                       |                   |                    |                     |
| BD 309604                           | 4,512                   | 0                     | 0                 | 0                  | 420                 |
| Tyco 1181200777                     | 17,222                  | 0                     | 0                 | 4                  | 418                 |
| <b>Twist-off<sup>i</sup></b>        |                         |                       |                   |                    |                     |
| Needle, 18 gauge                    |                         |                       |                   |                    |                     |
| Tyco 8881250016                     | 42                      | 0                     | 0                 | 0                  | 466                 |
| Syringe, 12 mL                      |                         |                       |                   |                    |                     |
| Tyco 8881512878                     | 181                     | 0                     | 0                 | 0                  | 749                 |
| <b>Burst<sup>j</sup></b>            |                         |                       |                   |                    |                     |
| Needle, 18 gauge                    |                         |                       |                   |                    |                     |
| BD 305196                           | 1,304                   | 0                     | 0                 | 0                  | 214                 |
| Terumo 3NN-1838R                    | 3,761                   | 0                     | 0                 | 8                  | 666                 |
| Tyco 1188818112                     | 1,803                   | 0                     | 0                 | 0                  | 447                 |
| Syringe, 1 mL                       |                         |                       |                   |                    |                     |
| BD 309628                           | 1,494                   | 1                     | 4                 | 60                 | 447                 |
| Tyco 1180100777                     | 1,925                   | 4                     | 0                 | 0                  | 525                 |
| Syringe, 12 mL                      |                         |                       |                   |                    |                     |
| Tyco 1181200777                     | 4,659                   | 28                    | 4                 | 128                | 293                 |
| Syringe, 60 mL                      |                         |                       |                   |                    |                     |
| Tyco 1186000077                     | 4,196                   | 37                    | 91                | 53                 | 567                 |

<sup>a</sup>Unless otherwise noted, results are combined for the laminar airflow workbench (LAFW) and biological safety cabinet (BSC).

<sup>b</sup>Probe #1 in the LAFW and #3 in the BSC.

<sup>c</sup>Probe #2 in the LAFW and BSC.

<sup>d</sup>Probe #3 in the LAFW and #4 in the BSC.

<sup>e</sup>Probe #4 in the LAFW and #5 in the BSC.

<sup>f</sup>Probe #5 outside the LAFW. There was no corresponding probe outside the BSC.

<sup>g</sup>Used for needles and syringes in soft packs.

<sup>h</sup>Used for needles and syringes in soft packs that were not all film.

<sup>i</sup>Used for needles and syringes in hard packs.

<sup>j</sup>Used for needles and syringes in soft pack strips.

## Methods of Opening Packages cited in article page 1445

1. Peel-and-present: This is the manufacturers' recommended method of opening packages. The operator opens the device packaging by peeling the top web from the bottom web, attempting to not tear any part of the packaging.
2. Pop-through: This method is not a recommended technique and is not supported by manufacturers; nevertheless, it is frequently used. The operator opens the device packaging by pushing the device out of the packaging through the paper side of the web, causing a tear in the paper.
3. Twist-off: This is the manufacturers' recommended method of opening certain rigid packages. The operator opens the device by twisting the base cap off the rigid plastic cylinder that contains the device.
4. Burst: The operator takes up strips of product packaging (five units per strip) and quickly separates them into individually packaged devices, which

are then opened with either the peel-and-present or pop-through method.