BC CANCER
Provincial Health Services Authority

Pharmacy FAQ

Volume Maximums

1. How much solution should be withdrawn from a bag before adding a hazardous or non-hazardous drug?

The volume to be withdrawn from a bag depends on the original prefilled infusion bag size and the volume of drug that is to be added. Solution bags are quite flexible and allow fairly large volumes to be added without difficulty. The intention of prior withdrawal is to ensure the final volume of the bag is not so large that administration is difficult and that there is no risk of the bag rupturing.

Commercially available infusion solution bags also contain additional "overfill" volume above the labelled volume amount, which can impact concentration and rate calculations.[1] These overfill volume estimates can vary by manufacturer and may be provided as a range. Individual hospital pharmacies have to determine what standardized volumes they will use for their preparation practices. In consultation with nursing, they also need to determine whether they will account for diluent bag overfill on pharmacy labels, as labelled volumes impact infusion pump programming practices.

BC Cancer pharmacy accounts for overfill on the pharmacy label and uses the guidelines in **Table 1** below for determining the volume to be withdrawn from a bag prior to adding the drug (hazardous or non-hazardous). If the volume of drug to be added **exceeds** the *Maximum Volume Addition Permitted Without Withdrawal* amount in the Table, the difference will be withdrawn. For example:

- **Volume of Additive:** 50 mL is the maximum volume allowed to be added to BC Cancer pharmacy's 250 mL and 500 mL size infusion bags. Note – other hospital pharmacies may use different maximum volumes.

- **Overfill Volume:** 25 mL is the estimated overfill in BC Cancer's 250 mL bags (250 mL + 25 mL overfill = 275 mL total volume). This is for both the DEHP-containing and DEHP-free 250 mL size bags. Note – this can vary for different brands and sizes. The estimated overfill volume for DEHP-containing 500 mL NS bags at BC Cancer is 50 mL (500 mL + 50 mL overfill = 550 mL NS total volume)[2], while for the more rigid (PVC-free/DEHP-free) 500 mL NS bags it is 25 mL (500 mL + 25 mL overfill = 525 mL NS total volume)[3,4].

- **Pharmacy Label:** Since 50 mL is the maximum volume that can be added to the 250 mL bag, to add 70 mL of rituximab (i.e., 700 mg of 10 mg/mL drug solution), 20 mL of NS will have to be removed from the diluent bag first. The pharmacy label will read:

riTUXimab 700mg	*70 mL*
sodium chloride 0.9% NS (with overfill)	*255 mL**
Total Volume:	*325 mL*

*The 250 mL diluent bag volume would initially default to 275 mL and require manual adjustment to reflect the 20 mL volume removal.

NOTE - there are special cases requiring different volume removal practices. For example, the manufacturer of daratumumab 20 mg/mL intravenous solution recommends withdrawing volume from a bag equal to the volume of drug to be added (regardless of bag size or overfill). Refer to the individual manufacturers' product monographs and the Cancer Drug Manual's *Chemotherapy Preparation and Stability Charts* for individual drug information.

Table 1 ***BC Cancer Pharmacy Overfill Estimates and Allowed Maximum Volumes***

Original Bag Volume	Average Overfill Volume	Original Bag Volume (factoring in overfill)	Maximum Volume Addition Permitted Without Withdrawal	Maximum Total Volume (factoring in overfill)
25 mL	5 mL	30 mL	25 mL (100%)	55 mL
50 mL	5 mL	55 mL	25 mL (50%)	80 mL
100 mL	10 mL	110 mL	50 mL (50%)	160 mL
250 mL	25 mL	275 mL	50 mL (20%)	325 mL
500 mL (non-DEHP)	25 mL	525 mL	50 mL (10%)	575 mL
500 mL	50 mL	550 mL	50 mL (10%)	600 mL
1000 mL	50 mL	1050 mL	100 mL (10%)	1150 mL

The table below shows other options to consider for adding a large drug volume to a bag:

Table 2 ***Example of Alternative Maximum Volume Limits***

Bag Size	Drain Bag When
250 mL	Greater than 85 mL: drain 250 mL from 500 mL bag
500 mL	Greater than 85 mL: drain 500 mL from 1000 mL bag
1000 mL	Greater than 110 mL: add 1000 mL IV fluid into empty 2000 mL bag

2. What is the maximum volume that a syringe can be filled with a hazardous drug?

During the entire hazardous drug sterile compounding process, syringes should only be filled to a maximum of 75% of the syringe's calibrated volume. This precaution is taken to minimize the risk of the plunger accidentally separating from the syringe barrel and causing a hazardous drug spill.

Table 3 ***BC Cancer Maximum Hazardous Drug Syringe Fill Volumes***

SYRINGE	MAXIMUM HAZARDOUS DRUG VOLUME (75%)
1 mL	0.75 mL
3 mL	2.25 mL
5 mL	3.75 mL
6 mL	4.5 mL
10 mL	7.5 mL
12 mL	9 mL
20 mL	15 mL
30 mL	22.5 mL
35 mL	26 mL
50 mL	37.5 mL
60 mL*	45 mL

*****Exception: Becton Dickinson (BD) removed the graduation markings beyond 50 mL on their 60 mL syringes (see Figure below). As no other changes were made to these syringes, BC Cancer has continued to fill them to 75% of the previously marked 60 mL capacity (i.e., now marked 50 mL but can still be filled up to 45 mL with hazardous drug solution).[5]

Figure: BD 60 mL capacity syringe

The above guidelines are only applicable to hazardous drug preparation in the pharmacy. They do not apply to non-hazardous drug syringe volumes.

Note that for syringes dispensed to nurses for IV push administration sites may follow additional guidelines. For example, a maximum volume of 30 mL in a syringe is dispensed for IV push administration at all BC Cancer Centres (i.e., doxorubicin doses greater than 30 mL are split into two syringes). This is an ergonomic limit for the maximum volume allowed to be administered from a single syringe that was decided in consultation with nursing. Another example is that a minimum syringe size of 10 mL is dispensed for IV push medication to be given directly through the main hub of a central line (e.g., leucovorin IV push to be given via PORT).[7] This is to limit the pressure that smaller syringes exert on the line and prevent catheter rupture.

References:

1. Understanding and Managing IV Container Overfill [Internet]. Institute for Safe Medication Practices Online. ISMP PA; 2013 Nov 14 [cited 2023 Feb 8]. Available from: https://www.ismp.org/resources/understanding-and-managing-iv-container-overfill
2. Baxter Corp. Email correspondence. Mississauga Ont; 2018 July 31.
3. B. Braun Medical. FAQ EXCEL® IV Container [Internet]. PA; 2021 Feb. Accessed 2023 Feb 08.
4. Fresenius Kabi Canada. Email correspondence. Toronto, Ont; 2025 Apr 7.
5. BC Cancer. Safe Handling Standards Manual section E.2.1 [Internet]. Vancouver BC: BC Cancer [updated continuously; accessed 2023 Feb 8]. Available from: http://www.bccancer.bc.ca/health-professionals/clinical-resources/pharmacy/safe-handling-manual
6. BC Cancer. III-50-07 IV Bag Size Selection for Drugs with Concentration-Dependent Stability or Large Drug Volume. Vancouver BC: BC Cancer 2021 April 28.
7. BC Cancer. Systemic Therapy Administration for Registered Nurses Procedure. Vancouver BC: BC Cancer 2025 Feb 20