RESOURCE

Comparative Life Cycle Assessment of Stainless Steel and One-way IBCs

Hoover CS commissioned a leading sustainability consulting firm to conduct a life cycle assessment (LCA) to compare the environmental impacts of reusable Stainless Steel (SS) intermediate bulk containers (IBCs) – also commonly referred to as totes – with plastic One-way IBCs when used for transporting chemicals between a chemical supplier and a chemical user. The LCA was conducted in accordance with ISO 14040 and 14044 standards[1], and underwent an extensive critical review by a panel of independent experts.

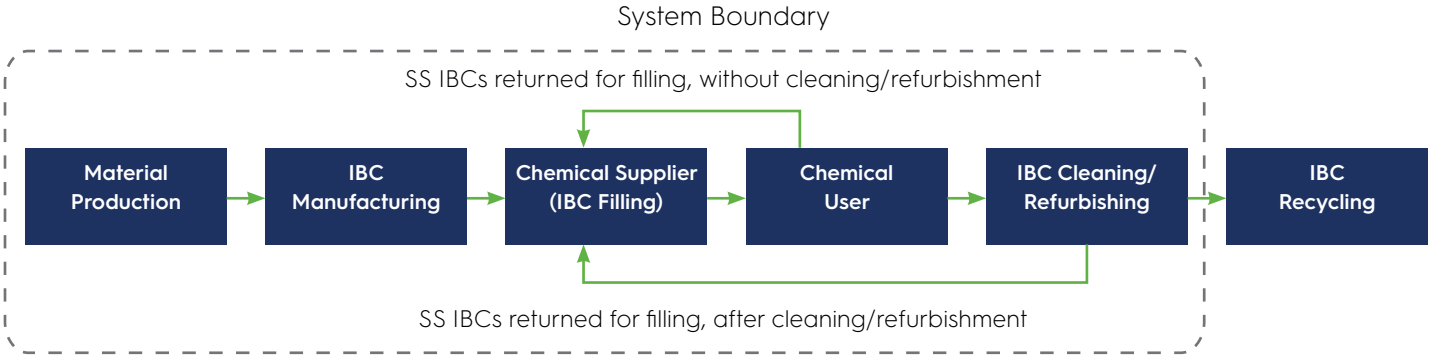
Key findings include:

- **Switching from One-way IBCs to reusable SS IBCs achieved significant reduction in all of the environmental impact categories studied**, including a 41% decrease in greenhouse gas emissions, a 54% decrease in energy usage, and an 89% decrease in water usage in the baseline scenario described below.
- Although the environmental impacts from transportation and cleaning are higher for SS IBCs (because the IBCs need to be returned and cleaned for reuse), these impacts are far outweighed by the environmental impacts of producing a new One-way IBC for every trip.

LCA SCOPE AND METHODOLOGY

Scope

The LCA included all phases of an IBC's lifecycle from material production and manufacturing, through filling, emptying, and cleaning, and until disposal.



Products

The LCA studied three products: the two standard size SS IBCs (350 and 550 gallon) and the largest standard One-way IBC (330 gallon).

350-gallon SS IBC	550-gallon SS IBC	330-gallon One-way IBC
Weight: 261 kg	Weight: 334 kg	Weight: 65 kg
99% stainless steel	99% stainless steel	51% high density polyethylene
25 year useful life	25 year useful life	49% galvanized steel

[1] 14040 and 14044 are the international standards for life cycle assessments maintained by the International Organization for Standardization, which is the independent, non-governmental international organization with a membership of 169 national standards bodies, including the American National Standards Institute.

Measure of Performance

The LCA measured the impact of delivering 1 million gallons of liquid chemical to chemical users. Delivering this volume of chemicals would require 3,030 One-way IBCs versus 19 350-gallon SS IBCs or 12 550-gallon SS IBCs (assuming 150 lifetime trips).

Scenarios

The LCA modeled the environmental impact of the following three scenarios, which were based on common operational variables in the chemical industry:

- **Scenario 1 (baseline):** SS IBCs are cleaned every trip (i.e., if filled with different products for each trip); One-way IBCs used for one trip.
- **Scenario 2:** SS IBCs are cleaned every six trips (i.e., if generally filled with the same product for each trip); One-way IBCs used for one trip.
- **Scenario 3:** SS IBCs are cleaned every trip; One-way IBCs used for two trips.
- **For each Scenario:** Transport distance of 160 km or 320 km.

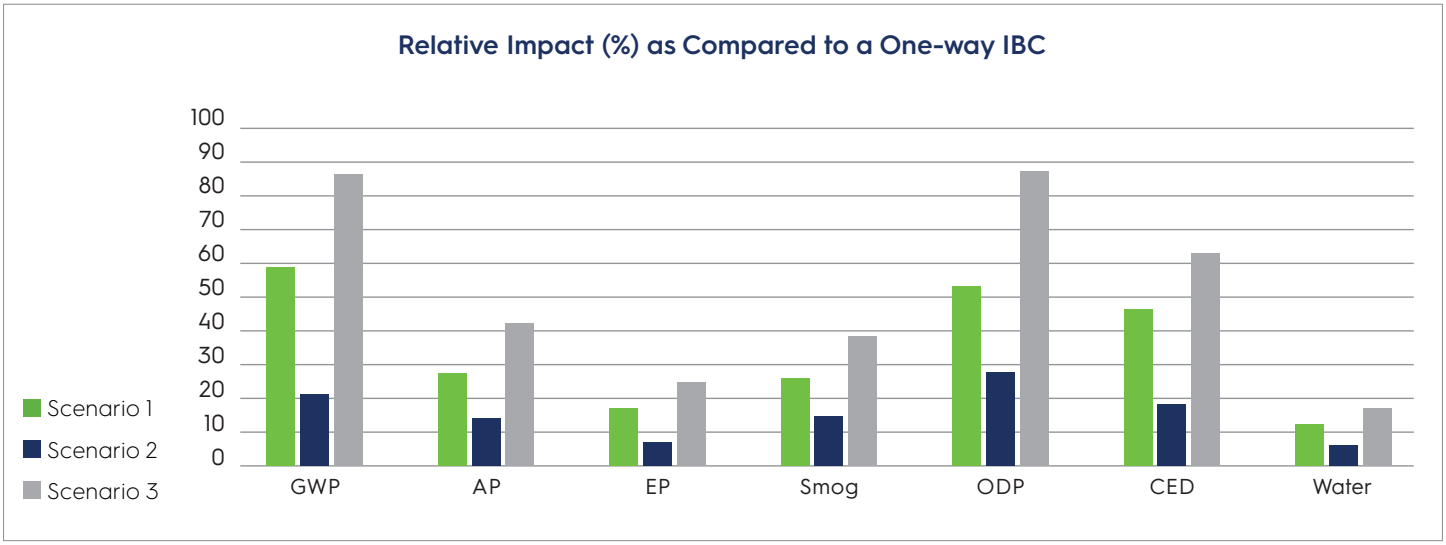
Environmental Impact Categories

The LCA measured performance in the following impact categories, which are the most recommended categories for studies of this type by the international LCA standard setting body:

- Climate Change (GWP)
- Terrestrial Acidification (AP)
- Freshwater Eutrophication (EP)
- Photochemical oxidant formation: ecosystem quality (Smog)
- Ozone depletion (ODP)
- Cumulative energy demand (CED)
- Water consumption (Water)

RESULTS OF THE STUDY

For all three scenarios studied (as described above), SS IBCs had lower environmental impacts than One-way IBCs across all categories. The table below shows the relative results for the impact categories using 350-gallon SS IBCs (at 320 km distance travelled) as compared to One-way IBCs.



As seen in the table above, the greenhouse gas emissions (GWP) resulting from using SS IBCs to transport 1 million gallons of chemical ranges from 20% of the comparable emissions if One-way IBCs were used (Scenario 2), to 87% in Scenario 3. Similarly, if you look at water usage, using SS IBCs requires only 5% of the water needed for One-way IBCs (Scenario 2), or 16% in Scenario 3. In other words, using SS IBCs yields a reduction in GWP ranging from 80% (Scenario 2) to 13% (Scenario 3) and results in water savings ranging from 95% (Scenario 2) to 84% (Scenario 3).

With over 1.6 billion gallons of chemicals shipped annually in the U.S. in One-way IBCs, the aggregate environmental benefits of transitioning these shipments to reusable SS IBCs would be a substantial. Using the same categories above, the reduction in greenhouse gas emissions would be **the equivalent of taking approximately 150,000 drivers off the road in the U.S. each year,** and the reduction in water usage would be **the equivalent of saving the water used to fill over 5,500 Olympic-sized swimming pools.**