

Containment & Hygienic Design

1	Containment (personnel protection) in solids handling	9
1.1	Significance	9
1.1.1	<i>Use of laminar flow units</i>	9
1.1.2	<i>Working in the full protection suit</i>	10
1.2	Definition of terms	11
1.3	Containment grades of products	11
1.4	Measurement of the residue limits (OEL)	14
1.5	Example of containment facility planning	15
1.5.1	<i>The FIBC (Flexible Intermediate Bulk Container) as a containment system</i>	17
1.5.2	<i>Isolators as a containment system</i>	18
1.5.3	<i>Transport and docking system for the FIBC</i>	20
1.5.4	<i>Feasibility study (mock-up)</i>	20
1.5.5	<i>Particle measurement of facilities in accordance with SMEPAC</i>	21
1.5.6	<i>Documentation and results</i>	23
1.6	Containment weak points	24
1.7	Containment systems for filling and emptying drums	25
1.7.1	<i>Drum filling with endless liner</i>	25
1.7.2	<i>Drum filling and emptying with DCS (Drum Containment System)</i>	25
1.7.3	<i>Big Bag emptying and filling with a protective liner system</i>	29
1.8	Container systems	31
1.8.1	<i>Container with outlet cone for discharging</i>	31
1.8.2	<i>Containment Transfer Unit at the container inlet for filling</i>	32
1.8.3	<i>Split valve systems</i>	34
1.8.4	<i>Laminar flow, Glove box systems (isolators)</i>	35
1.9	Filter systems	36
1.10	Sampling	36
1.10.1	<i>System 1: Sampling via a withdrawal screw fitted in the production area</i>	37

1.10.2	System 2: Sampling via a micro Powder Transfer System (MPTS)	38
1.11	Containment on equipment	39
1.11.1	Example 1: Shaft leadthroughs	39
1.11.2	Example 2: Filling and discharging cone dryers	39
1.11.3	Practical example of a containment API plant	40
2	Hygienic design for the use of solids	41
2.1	Surfaces	45
2.2	Materials	49
2.2.1	Coating of stainless steel surfaces	51
2.2.2	Weld	52
2.3	Hoists in hygienic design	54
2.4	Connections	59
2.4.1	Flange connections and quick-release connections (Tri-Clamp connections)	59
2.4.2	Seals	63
2.4.3	Compensators and flexible transitions	64
2.4.4	Screw connections	67
2.5	Design of filling and discharging systems	71
2.5.1	Discharging systems for bags and sacks	72
2.5.2	Filling systems for bags and sacks	73
2.5.3	Discharging systems for Big Bags	80
2.5.4	Filling systems for Big Bags	82
2.5.5	Discharging systems for containers	85
2.5.6	Filling systems for containers	86
2.6	Roller conveyors	88
2.7	Pneumatic conveyor system	92
2.7.1	Vacuum conveying system with separator (dilute phase conveying)	93
2.7.2	Powder Transfer System (PTS – dense phase conveying)	94
2.8	Dosing systems	97
2.8.1	Vibration dosing device	97
2.8.2	Metering screws	98
2.8.3	Slide dosing gate	99
2.8.4	Flexible metering system	100
2.8.5	Transbatch feeder	100
2.9	CIP cleaning	101
2.10	Clean room installations with examples	104
2.10.1	Rail design - example of a clean room installation	104
2.10.2	Installation of panels in clean rooms	106
2.10.3	Cable ducts	106

2.10.4	<i>Lifting columns instead of numerous stands and pipes</i>	110
2.11	Design of platforms and stands	110
2.11.1	<i>Platform design</i>	110
2.12	Sources of Information	113
Author		115
Index		117