Program content

1. **Introduction**

2. **Design Constraints and Requirements**
   - History, Standardisation & Legal Aspects
   - Machinery Directive; NEN-EN 1672; ISO 14159; NSF 3-A, **EHEDG**;
   - General Food Law

3. **Know Your Enemy™**
   - Damage and losses caused
   - Functional microbiology
   - Contamination/invasion mechanisms
   - Colonisation, biofilms, preservation and death

4. **Scientific background EHEDG documents**
   - EHEDG Test Methods, three tests, results on sheet

5. **Hygienic Design of Food Production Systems**
   - Uses Know Your Enemy™ to explain reasons behind design rules
   - Introduction document 8 & 10
   - Cleanability
   - Bad examples and effective solutions™
   - Wider coverage than just equipment

6. **Material of Construction**
   - Stainless steel; corrosion; surface finish
   - Polymer use; FDA, Limitations, Management, Desorption
   - Background information integrity polymer surface (for seals)

7. **Welding Stainless Steel**
   - Also set-up project; QA - QC incoming materials
   - Permanent joint

8. **Static Seals and Couplings**
   - Design principle static seals; examples

9. **Case Study: Spray Ball**
   - Application; define: product contact areas; redesign model

10. **Background: Rheology / Thermodynamics**
    - Newtonian / non-Newtonian fluids; yield value (needed to understand case pump)
    - Flow rate; removal of micro-organism; falling film; results for closed equipment applicable to open equipment
    - Fouling heat treatment; sterilisation time (needed for heat treatment and reaction time)

11. **Valves**
    - Valve types
    - Hygienic versus aseptic
    - Double-seat valve
    - Case study weir-type valve

12. **Dynamics Seals (Pumps)**
    - Case Positive replacement pump with application; safety valve and yield value
13. **Cleaning and Disinfection**
   Up to now focus on removing invisible micro-organisms, but firstly visual soil has to be removed
   o Cleaning & Disinfection: background, application
   o Fouling, cleaning agents, cleaning methods (Sinner circle), CIP, ATP

14. **Continuous Thermal Treatment Processes**

15. **Open Equipment Design**

16. **Packaging**

17. **Supporting Activities - Lubrication Use**
   o FDA, Limitations, Management (following bearings; dynamic seals)

18. **Building & Process Lay Out**
   o Design around process, equipment, logistics, etc.

19. **Supporting Activities - Installation & Maintenance Procedures**

20. **Integration of Hygienic Systems**
   o Risk management paramount - evidenced-based!
   o Starts with constraints: law, hygiene hazards, stakeholder requirements
   o All steps correct and present
   o Right sequence
   o Concurrency
   o Prescriptive design versus risk assessment
   - Buying and selling hygienic Equipment

21. **Case Study (Pilot equipment and examples)**
   Small groups assessing various pilot equipment and examples of components

22. **Plenary Discussion**
   o Presentation each group of results case study

23. **Student Course Evaluation**