Keynotes

Review of Key Comments on Draft Revision of EU GMP Annex 1 Prepared by a PHSS Annex 1 Focus Group
James L. Drinkwater, Franz Ziel & Chairman of (PHSS), UK
Key comments on the draft revision of Annex 1; Manufacture of Sterile medicinal products will be presented with an explanation why the comments and suggested changes/ clarity to the Annex 1 revision is thought necessary.

Virtual Reality Models in Cleanroom Design
Tero Järvinen, Granlund Oy, Finland
The use of Virtual Reality (VR) possibilities has increased in past years due to technology improvements. The driving force has been gaming industry. The construction sector has been able to benefit from the technology leaps carried out by other industries. The Building Information Models (BIM) have been in use by architects, structural and mechanical designers since the early 2000's. The use of BIM models in Nordic countries is a normal way to design and the construction companies are able to utilize these models quite easily. By combining BIM processes and current VR technologies we are in situation that the use of VR glasses can be a common mean with which the design in construction projects can be promoted. When combining the VR glasses with models the end users can obtain a better understanding of what architects and engineers are designing than based only on models. With VR glasses on the users can walk inside the rooms and see objects in real scale. In this presentation, the use of VR models will be demonstrated using real use cases from construction projects.

Cleanroom Zoning, the Challenge of Pressure Differential and Flow - Practical Implementation of Basic Physical Phenomena
Frans Saurwalt, Kropman Contamination Control
When separating rooms with different classes and / or usage, a differential pressure hierarchy is usually designed for. This however not always results in a stable and robust situation. Various factors, including total airflow, room permeability and size, play an important role in designing and monitoring such a zoning. Based on a number of basic insights, an improved understanding is given to distinguish which designs and parameters are appropriate. The regulatory framework is taken into account in the considerations as well. For non-containment situations a stable and energy efficient solution is presented.

Pharma & Hospital Pharmacy

A Practical Approach to GMP Cleanrooms and Cleanroom HVAC
Markku Mäkinen, Elomatic, Finland
A practical approach to achieve Good Manufacturing Practice (GMP) cleanrooms and cleanroom HVAC in the pharmaceutical industry rests on the comprehension of and adherence to a set of basic rules that have been penned by several GMP regulatory authorities. Rules are nevertheless open to subjective interpretation and herein lie some potential pitfalls. The world community of cleanroom designers mostly follows the ISO 14644 standard. International Society for Pharmaceutical Engineering (ISPE) has provided a set of tools that facilitates a clearer understanding of the application of different GMP regulations, standards and guidelines. Local laws and codes naturally have to be applied in every aspect in order for project goals to be fulfilled.
Once a project has started, it is advisable to follow the ISPE general V-model. In this model, User Requirement Specifications (URS) are created first using a risk assessment based approach and are followed by a Validation Master Plan (VMP) and URS. Secondly, Functional Requirements (FRS) and Design Specifications (DDS) are compiled with a stage-gated approach, where the engineering process proceeds as follows: Conceptual Design, Basic Design (or Functional Design) and Detail Design. The V-model also guides execution: Design Review and/or Design Qualification, Implementation (Construction), Installation Qualification, Operational Qualification and Performance Qualification. Finally, all requirements in the URS are fulfilled and approved.

GMP-grade Clinical Cell Production with an Isolator System - Key Considerations
Timo Kangasmaa, MSc, Finnish Red Cross Blood Service, Finland
The Finnish Red Cross Blood Service (FRCBS) is a non-profit organization responsible for collecting blood and supplying blood products to all Finnish hospitals in a centralized manner. The FRCBS has been involved in stem cell and novel cell therapy research since 2002 and the Advanced Cell Therapy Centre (Solutuotantokeskus) with its GMP facilities for the development and manufacturing of novel cell therapy products has been operational since 2012. Parenteral cell therapy products intended for clinical use should always be produced in a controlled clean room environment according to a quality system and must comply with current legislation and good manufacturing practices (GMP principles).
The core of the FRCBS GMP facility is an aseptic cell isolator system of class A in a class D background. The isolator consists of a six chamber arrangement providing defined barriers. All needed accessory devices such as cell culture incubators, centrifuge, fridge, microscope and a decontamination system has been integrated within the isolator system. Currently, the isolator system is utilized for the manufacture of mesenchymal stromal cells for the experimental treatment of refractory graft versus host disease (GVHD), a severe complication of hematopoietic stem cell transplant patients.
The manufacture of cell therapy medicinal products is different from conventional medicine manufacturing, and expertise especially in cell biology, microbiology and process technology is critical. The presentation will provide a description of the validation procedure of a new isolator system and examples of how the revalidation procedures of the hydrogen peroxide decontamination system have been performed. The presentation will also exemplify practical challenges related to operations, since a cell culture batch takes up to four weeks to manufacture. Results of environmental monitoring and in-process controls will also be presented.

Usage of Contamination Recovery Rates as Control Indicator for Aseptic Environment - A Case Study
Alexander Stoll, Fresenius Kabi AB, Uppsala, Sweden
Contamination Recovery Rates (CRRs) were introduced in USP <1116> a few years ago as a tool for monitoring aseptic processing environments in cleanrooms grade A and B. However, the additional benefit of this new quality indicator has not been very obvious from the start, which led to a hesitant implementation at manufacturing sites. Gaining experience after implementation of CRRs at manufacturing sites, this way of measurement has been proven to be an excellent monitoring tool for the evaluation of both, processes within cleanrooms, and cleanroom-designs. Compared to only focusing on action limit excursions (OOLs), CRRs give more accurate data on the cleanroom status and also allow comparison of data in between manufacturing sites.
In this presentation the influence of cleanroom-processes and cleanroom-design changes on CRRs are shown for a real case example of a sterility testing suite grade B area. CRRs will be shown to be an effective tool for cleanroom monitoring, but also providing an excellent way to verify effectiveness for improvement actions implemented.

Risk-based Environmental Control and Monitoring; PHSS Guidance Initiative

James L. Drinkwater, Franz Ziel & Chairman of PHSS, UK

This presentation reviews current developments and practices in Risk based environmental control and monitoring that form the basis of PHSS Guidance set around case studies including Pharmaceutical Filling, ATMP processing, Sterility testing and Pharmacy aseptic compounding.

Development of a Harmonized Method for Cleanroom Hard Surface Disinfectant Efficacy Evaluations

James Tucker Ecolab Contamination Control, UK

This presentation explores the development of a test method which overcomes the shortfalls in existing methods and guidance documentation. It also explores the validation behind the method which covers, parameters and repeatability as highlighted below. It will explore equivalence testing considerations and method design to harmonize common variables in the test method e.g. surface, chemistry and microorganism. It will also explore development the variability seen within biological test systems and methods developed to understand these parameters and define this into the final method. This presentation also details factors that should be considered prior to any testing to minimize the potential for validation failures or retests. The use of the harmonized method and consideration of the factors discussed will aid in the creation of a robust disinfectant efficacy study that will stand up to regulatory scrutiny across the globe. The learning outcome will be understand the development allowing for implementation of a strategy and rationale for disinfectant validation testing that is in line with this global harmonized approach. This universal method developed by Ecolab Life Sciences enables end users to select a validated efficacy testing method, which can be adapted for their own facility cleanroom surfaces and isolates. Use of the harmonized method can also give companies a transferable platform to achieve replicable results between laboratories and countries.

Design of GMP Premises

Jukka Vasara, Granlund Oy, Finland

The clean room design of pharmaceutical industry and hospital pharmacies is guided by GMP- guidelines. A document detailing the design limits is drafted in co-operation with the user for the start of the project. This document describes the operations that will take place in the clean room i.e. material flows, personnel flows, GMP- classification and the basic requirements for HVAC-systems. The most important factors regarding the operation of a clean room are well functioning layout and technical systems with clean room structures. In the layout design phase it is important to take into account the operations carried out in the clean room, the space required by furnishing, the positioning of laminar airflow cabinets, pass through cabinets etc.

Structures in GMP clean rooms are normally constructed by using clean room elements. Ventilation is implemented by using a specific AHU appointed for the clean room. Pressure differences between spaces within the clean room are maintained by using a pressure control system which reacts to the smallest of variations in airflows and maintains the room pressure in its set point. Conditions within the clean room are monitored by using a separate validated monitoring system. Before starting operations in the clean room the facilities, equipment and technical systems must be validated.

How to Successfully Implement a Real-time Microbial Monitoring System into an Isolator

Thomas Lööf, Brookhaven Instruments, Sweden

Technology is moving fast these days and for the last 7 years the traditional microbial sampling methods in clean rooms has been challenged with real-time monitoring solutions to give data instantly if a room or area is in compliance. This presentation will focus on how the technology works and also on how you can install, validate and benefit from an real-time microbial monitoring instrument in an Isolator environment.

Continuous Monitoring of Environmental Conditions Keeps Data and Assets Safe

Piritta Maunu, Vaisala Oyj, Finland

Monitoring environmental conditions in pharmaceutical and health care facilities is sometimes still performed manually with handwritten notes, or mechanically with chart recorders. Building management systems (BMS) or building automation systems (BAS) are also used to monitor environmental parameters like temperature and humidity. However, several factors are changing how companies monitor controlled environments, including: the growing number of available technological solutions, globalization of operations, increasing costs of bringing products to market, and new, secure and easily expandable monitoring systems. Based on those factors many companies are currently turning to automated continuous monitoring systems.

When choosing a monitoring system for life science facilities and processes, the system should be specified, designed, implemented and tested according to relevant standards and guidelines. For example, ISPE GAMP 5 book is a great source of information for GxP regulated companies looking for information on how to adhere to current good practices.

Regulatory requirements for computerized systems are specified in FDA's Title 21 CFR Part 11 and the EU's GMP Eudralex Volume 4, Chapter 4 and Annex 11. Also latest EU Good Distribution Practice regulation (2013/C 343/01) requires monitoring activities when medicinal products for human use are stored or transported before administration. Obviously all monitoring systems should be designed to be compliant with regulatory requirements when used e.g. in GMP, GDP or GCP activities.

Most continuous monitoring systems used in life science environments seek to help firms comply with guidance; however, the best continuous monitoring systems have some key additional features. Ideally, the system should be able to monitor many different activities and parameters simultaneously. Additionally, global operations covering several different manufacturing and distribution locations can benefit from an enterprise-wide system. This type of system makes validation and life cycle management activities a lot less cumbersome. Finally, a vendor that is experienced in GxP-regulated applications can greatly help with system-related risk assessments, support faster system deployment, change management and system retirement activities.

In this session, we will explore continuous monitoring systems, their value, and benefits when compared to more traditional methods of environmental monitoring. In addition, we will walk through applications, processes and parameters that are typically monitored, giving several examples from industry. Recently, regulators and auditors have focused on data integrity in both manual and electronic systems. We will describe how data integrity issues should be considered, and handled in automated monitoring systems in regulated and critical applications.

Required Preconditions for GMP Facilities
Esa Högel, Alpiq InTec Switzerland Ltd., Switzerland
In order to make successfully design, build and maintain clean rooms, we need to know the layout, material and the user`s requirements of clean room classification. The better the clean room class requested is, the more careful design, the better surface materials and the better air conditioning must be used. The cleaning must be properly performed. Appropriate clothing systems and proper locker rooms must be used. In the process the equipment must be properly optimized and the staff, which performs the work, well-trained.

Hospitals

Protective Supply Air Distribution in Hospital Isolation Rooms
Petri Kalliomäki & Hannu Koskela, Turku Univ. of Applied Sciences
Typically in hospitals patients with airborne infections are placed into negative pressure isolation rooms. The negative pressure directs the airflows between rooms towards the isolation room thus preventing containment failures from happening. Inside the isolation the room the air flow patterns govern the dispersion of airborne pathogens. Hence, proper supply air distribution can provide additional protection to healthcare workers (HCW) (complementary to personal protective equipment) and decrease the exposure risk to patient released airborne pathogens.

In this study, the effect of two different supply air distribution modes on HCW exposure to airborne infections were tested: local unidirectional and overhead mixing ventilation. The local unidirectional air distribution mode provides fresh air locally downward from the ceiling to the occupied zone and mixing ventilation supplies the air along the ceiling evenly over the room.

The experiments were carried out in a full-scale isolation room model built into a ventilation laboratory. In the experiments the HCW and the patient were simulated with breathing thermal manikins. Smoke visualizations, tracer gas experiments and thermal comfort measurements were carried out to assess the performance of the ventilation modes and the HCW exposure to patient exhaled airborne pathogens.

Smoke visualizations illustrated that the unidirectional air supply directed the exhaled air away from the HCW's breathing zone more efficiently than the overhead mixing ventilation. Tracer gas measurements showed substantial differences in the exposure especially close to the patient where the local unidirectional air supply mode produced 5-15 times smaller exposure rates than the overhead mixing ventilation.

Local unidirectional air supply has the potential to reduce the exposure of the HCW to patient-exhaled airborne pathogens. The performance of this and other local air distribution methods for isolation rooms should be studied in more detail in the future to develop practical protective ventilation solutions.

New Standard for Ventilation in Hospital - Isolation Units
Kari Solem Aune, Sykehusbygg, Norway
The CEN working group for "Ventilation in Hospitals" is currently working with part 3 "Ventilation in isolation units". The background for this part is the lack of common European guidelines for ventilation in isolation units. There are some existing national and international guidelines, which are slightly different from each other. This lecture will explain the strategy for the new CEN-standard, where the most important issues are: source strength, recovery and air tightness.

The most common strategy in the Nordic countries (as well as in Europe) has until now been to rely on pressure difference between corridor, airlock and patient room. This is now turning into the fact that the only way to control contaminants is to have enough air changes, combined with the right airflow direction. To prove this, the main tests will be recovery time and air tightness of the construction around the unit. There will also be some examples of how this principle can be solved by different technical solutions.

Operating Room Ventilation: CFU-concentration Measurements
Aleksanteri Setälä, Aalto University, Finland
Operating room air quality has a great influence on patient safety. Microbes are often carried to the surgical wound via operating room indoor air. Currently there is not a valid standard about operating room ventilation design in Finland. In addition, the air quality is not required to be monitored or verified after the introduction of an operating suite. However, European Committee for Standardization (CEN) is working on a European-wide standard "CEN/TC156 WG 18" which focuses on hospital air quality and ventilation design. The standard draft defines two levels for operating room air quality: Clean Air and Ultra Clean Air. The factor that defines the air quality is the colony-forming unit concentration of indoor air (CFU/m^3).

In this research the CFU concentration in the indoor air was measured in various operating rooms in Finnish hospitals. The results were compared with the suggested levels of the CEN standard draft. The purpose of this research is to examine how Finnish operating rooms align with the suggestions of the standard and to discuss reasons for the air quality test results.

A Comparison between Measured Values of Airborne Viable Particles and Theoretical Calculated Values with the Dilution Principle in Operating Rooms Equipped with Low Velocities Unidirectional Air Flow Systems
Bengt Ljungqvist & Berit Reinmüller, Chalmers Univ. of Technology
Operating rooms for patients undergoing surgery susceptible to infections often have unidirectional flow (UDF) supply air systems. In the past 25 years, many UDF supply air systems installed in Europe have low air velocities, i.e., equal and below 0.3 m/s. Measurements of airborne viable particles (aerobic CFUs) were performed during ongoing surgery in operating rooms equipped with UDF ceilings at three different hospitals in Sweden. Data from these measurements for three different types of UDF unites will be discussed. The measured mean value concentrations of bacteria-carrying particles (aerobic CFUs) in the operating rooms with UDF units are compared to theoretical calculated values with the aid of the dilution principle, i.e., total mixing air movements. The results show that measured mean value concentrations of aerobic CFUs during ongoing surgery in operating rooms with UDF supply air systems (UDF ceilings) are in the same range as the mean value concentrations calculated with the expression of the dilution principle.

Protective Efficacy of a Surgical Clothing System without and with Textile Knee-length Boots Concerning Airborne Microorganisms during Ongoing Hip Joint Surgery
Bengt Ljungqvist & Berit Reinmüller, Chalmers Univ. of Technology
The number of airborne bacteria-carrying particles in the operating room is considered as an indicator of the risk of infections to the patient undergoing surgery susceptible to infections. To reduce surgical site infection, it is desirable to keep the bacteria-carrying particles at a low number in the operating room air, especially during orthopedic prosthetic surgery. The main source of microorganisms in an operating room is usually the staff and the patient. In order to reduce the number of airborne bacteria-carrying particles from the staff, it is important that the surgical

team and assistant nurses wear a functional clothing system. This presentation compares results from measurement studies of the protective efficacy, i.e., source strength, of a surgical clothing system (fabric Olefin) with textile hood and with two types of footwear. One type had clean socks and disinfected plastic shoes, while the other type had textile knee-length textile boots over the clean socks and disinfected plastic shoes. The studies were performed in a dispersal chamber and in operating rooms during ongoing hip joint surgery. The results show that with textile knee-length boots a considerable reduction occurs on the source strength, i.e., microbial air cleanliness in the operating room.

Food & Biotech

Good Manufacturing Practice in the Food and Biotech Industry – Requirements in Manufacturing Unit Design
Riina Brade, Elomatic, Finland
Good Manufacturing Practice (GMP) is a term that is recognized worldwide for the control and management of manufacturing, as well as the quality control of foods, pharmaceutical products, medical devices, and even packaging and materials that come into contact with food. EU GMP guidelines include Eudralex VOL 4 Good Manufacturing Practice (GMP) and for food manufacturing the code of practice and hygiene published originally by Codex Alimentarius.

With the above-mentioned guidelines and related legislation, as well as with the support of manufacturers' hazard analyses and risk assessments, the minimum requirements are set which manufacturers must meet to safeguard the health of consumers and patients and produce good quality food and medicine. So what is the challenge?

The GMP guidelines are not prescriptive instructions on how to manufacture products. They are a series of general principles that must be observed during manufacturing. When a company sets up its quality program and manufacturing process, it can fulfil GMP requirements in many different ways. It is the company's responsibility to determine the most effective and efficient procedures, facilities, materials, equipment and controls.

New ISO16890 for Air filters – Focus on Clean Air in Food & Biotech Processing
Erkki Koskinen, Camfil Oy, Finland
After a long process over several years all involved countries in the world have finally come to a common decision. The future global test standard for air filters is called ISO16890 and it will replace the existing standards, EN779:2012 (Europe) and ASHRAE 52.2 (USA, Asia and Middle East). EN779:2012 will be deleted in the end of August 2018 and until then, both standards are valid. ISO16890 has a completely new way of classifying air filter products. All manufacturers must make new tests and adapt all their products accordingly. With the new ISO16890 standard we can get a relation between the outdoor air particles and the effect of the inlet air in regards of filter efficiency. The old (but still existing) EN779:2012 is based on filtration efficiency focused only 0.4 µm particle size, but new ISO16890 gives more intuitive filtration performance related to particulate matters PM10, PM2.5 and PM1. Clean air is one important ingredient - the "invisible raw material" – in sensitive Food, Beverage, Biotech and BioPharma manufacturing processes. Hygienic aspects and standards must be considered at the production stages, which will maintain and possibly also improve the product safety.

Contamination Control and the Food Industry - Combined Challenges Explored
Frans Saurwalt, Kropman Contamination Control, NL
Over the years a distinct distance can be observed between the worlds of cleanroom oriented contamination control such as the micro-electronics, the pharma-biotech and to some extent the medical devices and healthcare and the food processing industry. This can be historically understood but current developments in detection techniques as well as increasing understanding of contamination mechanisms open the pathways to more adequate control. Furthermore, hygienic design has been developing to avoid open process steps, reduce accumulation and to improve cleanability. As a case a typical integrated hygienic spray drying factory, designed and build according hygienic and contamination control standards such as EHEDG and 14644-4, producing ingredients for baby food, is illustrated.

Genomics in Assessing Microbial Contamination Risks
Eveliina Munukka, Turku University of Applied Sciences, Finland
Traditionally, cleanrooms have been considered microbial-reduced or even -free environments that are utilized to protect human health and industrial product assembly. However, recent genomic analyses based on mainly next generation sequencing (NGS) have revealed that actually rather diverse microbial ecosystems exists in cleanrooms. Both the origin as well as physiological status of these microbes has not yet been fully understood. Thus, this modern analysis methodology repertoire will increase our knowledge of the strict controlled built environments.

General

Safety ventilation in ultraclean air operating rooms
Bengt Ljungqvist & Berit Reinmüller, Chalmers Univ. of Technology
An introduction to air movements and contamination in controlled environments is given. Resistant bacteria occur in the hospital environment. The number of airborne CFUs in the operating theatres is an indicator of the patients' risk to obtain infections, which occurs especially in infection-sensitive surgery e.g. in implant surgery (hip joint surgery). The development of ventilation in operating theatres will be described and compared with the corresponding development in the pharmaceutical industry.

Surgical clothing systems for ultraclean air operating rooms
Bengt Ljungqvist & Berit Reinmüller, Chalmers Univ. of Technology
Clothing systems for ultra-air operating rooms are compared with clothing systems used in aseptic manufacturing of sterile products with regard to both design and source strength. Source strength is a measure of the filtration efficiency of the clothing system to prevent particulate and CFU dispersion from persons to ambient air. The relationship between the source strength of clothing systems and the airflow of the ventilation will be discussed.

From Individual Thermal Sensation to Smart Control of Heating and Cooling
Pekka Tuomaala, VTT Oy, Finland
According to several earlier research studies and practical experiences, indoor temperature levels have essential impacts on both thermal satisfaction of occupants and energy consumption of buildings. At the same time, indoor environment quality related complains are most often related to thermal conditions. Seasonal, weekly, and daily variations in boundary conditions can be fairly well controlled by heating and cooling systems, but there are still some challenges when balancing between thermal satisfaction of occupants and energy conservation.

Lean to Enhance Cleanroom Efficiency
Jori Reijula, Granlund Consulting Oy, Finland
Background: Regardless of the industry sector, cleanroom efficiency should be held at a high level in order to maintain an adequate level of productivity and cost-efficiency. For instance, today's hospital cleanroom (e.g. operating room) usage rates as well as management of personnel's work tasks have often been perceived as inadequate. Lean methodologies can increase cleanroom efficiency by streamlining work processes and eliminating non-value-added steps. Material and Methods: In this study, over 20 research studies assessing use of Lean in cleanrooms (healthcare, pharmacology and biomedicine) have been reviewed. Results: The use of Lean in cleanrooms has led to decreased variation among customer volumes, scheduling, and usage rate of cleanroom facilities. Communication, information and work flow, cost-efficiency, work process efficiency and employee commitment had all improved due to Lean. However, a significant portion of employees' work time is still oftentimes spent on wasteful activities. Conclusions: A need exists for more systematic implementation and facilitation of Lean in cleanrooms. Future development needs for a successful Lean implementation project include e.g. personnel training, a wide-ranging system approach, innovative change and resource management framework as well as Lean driven facility design.

Design of Microbiological Safety Cabinets that Meets Increasing and More Stringent Requirements of the New EN Norm in Industry
Heikki Aro, Kojair, Finland
This presentation reviews current aspects for design and control safety cabinets and give some examples of solutions. Important role is playing tests with EN-12469 and new EN-ISO 3744 standards.

The Antimicrobial and Air-purifying Effect of Blue Light
Camilla Höglund, LED TAILOR INNOVATION, Finland
The antimicrobial effect of blue light has recently attracted a lot of attention, even more since the increased antibiotic and disinfectant resistance among microbes has been recognized as a global threat. Although the mechanisms of action are not fully understood, there are known endogenous photosensitizers within microbial cells that absorbs blue light effectively. This will subsequently result in production of cytotoxic reactive oxidative species (ROS). Studies have shown different wavelengths of blue light to be effective in inactivating a wide range of microbes; Gram-positive and Gram-negative bacteria, moulds and yeast, both in planktonic and biofilm forms. In addition, blue light appears to significantly decrease other airborne particles. In a case-study from an industrial cleanroom, the ISO-14644 classification of the cleanroom could be reduced from ISO 6 to ISO 4 after installing blue LED lights (to be used at night). The reduction of airborne particles in the cleanroom was >98 % and >60 % for particles <1.0µm respective 1.0 – 5.0 µm. Light offers a chemical-free, continuous disinfection of the air and surfaces, without causing harm to humans or surfaces. There are limitations, but blue light is worth to consider as a complement to the existing disinfection systems.

Introduction to Cleanroom Technology
Lennart Hultberg, Processhygien, Sweden
What is cleanroom technology? This can be described as one or several technologies used to create cleanliness for a process / product. The next question then pops up quickly. What is clean? Here you probably get as many answers as people ask. The answer you get is subjective, we have all the different levels / requirements for what we think is clean. We usually relate purely with visually clean or the degree of how dirty things may be, that is acceptable to me. For example the room, the dishes, clothes etc. The degree of cleanliness is also dependent on what requirements I have for my process. What contaminants (pollution) am I worried about? What gives me a level that is not acceptable to my process / product?

Cleanliness can be divided into visually clean, chemically clean, microbiologically clean, but also particulate clean (particles not visible to the naked eye). A basic rule regarding sampling and cleanliness is: If it´s not visually clean, you can ignore it being chemical, microbiological or particulate clean. Then you do not need to take any tests to understand the result. In all clean spaces there are more or less contaminants (such as dirt, contaminants that you do not wish in this local / process). The biggest challenge is that these contaminants do not occur near by the most critical area of the process. A process can be, for example surgery, manufacturing of pharmaceuticals or medical devices, microelectronics, optics or food products. In different processes, the requirements differ in cleanliness. Certain processes are sensitive to living contaminants, but small particles are no problem. Other processes do not care for living organisms on the particle, but it is the particle as such that creates problems. In other words, different processes have different challenges to handle.

What is required to succeed with its "cleanliness" in a process? To succeed, a holistic approach is required. We can create the best conditions technically, but unless the staff follows set rules (attitudes) or do not have the right education / skills for a task, the result will not be satisfactory. However, poorer technical conditions can nevertheless provide a good result if you have the "right staff". The old cliché "Nothing is stronger than its weakest chain" fits very well here.

Design of high containment facilities for research – practical approaches and future visions
Anette Bonsted, Erichsen & Horgen AS, Norway
The design of modern and functional high containment facilities should attract top researchers and allow long-term stable operations. Today, high containment facilities are often experienced as unpleasant spaces with elevated operational costs and uncertain funding. In this presentation, practical approaches to the design phase will be discussed. For example, how are the room tightness requirements defined, and what are the consequences? Why does the design team require information about flow of personnel, materials and waste? Which primary and secondary containment issues are important to resolve? How should the technical areas be placed in order to serve the containment area? Future visions on how surrounding areas may add value to the containment area will be discussed.

Cleanroom Disinfection - An Important Part in Contamination Control and in the GMP
Jennie von Fielitz, Miclev AB, Sweden
Effective cleaning and disinfection is an important part of contamination control and GMP. This presentation helps us understand which factors should be considered, when designing the cleaning and disinfection routines - both regarding user requirements, risk management, disinfectant type, contact surface materials etc. We need both microbiological and particle control methods for checking the quality of the work performed in the cleanrooms. The cleaning agents, disinfectants, wipes and cloths used in the cleanroom environment must fit the purpose, they should neither harm materials nor operators in the cleanroom environment. Furthermore, there must be appropriate documentation, how to work properly, available.

There are many requirements, when choosing disinfectants. Does the perfect disinfectant exist or must we always compromise? We need to know the effectiveness, the microbiological effect and the amount of each disinfectant we intend to use. You must be careful about how the products affect the environment and what requirements the authorities have set. The method chosen is also important. Decisions about appropriate technology require a balance of risk assessment, practical use and the overall effect. Find out whether the disinfectant should be sprayed or wiped, or whether you should use mops and cloths instead. What is the best form of disinfectants on smaller and on larger surfaces? In order to be effective, a controlled and consistent technique must be used to promote that everyone uses the same work model/ course, when carrying out the work. Anyone working with disinfection in cleanrooms should not only know how to perform the work, the practician should also know why the work is done.

Microbial Surface Hygiene

Gun Wirtanen, University of Helsinki, Ruralia Institute, Finland

Microbes prefer attaching on solid surfaces rather than being in the liquid phase and therefore is the microbial contamination of food often related to microbes on the process surfaces. Microbes that inhabit contact and environmental sites in food processing are mostly harmful, because microbial communities in biofilms of either spoilage microbes or pathogens in the wrong places lead to contamination of firstly the process surfaces and secondly the products produced in the process. The cleanliness of surfaces, training of personnel and good manufacturing and design practices are the most important tools in combating biofilm problems in the food industry. Improper cleaning and disinfection procedures of food equipment surfaces contribute to foodborne illness episodes. Microbes found on environmental surfaces have also an impact on the product quality especially on products produced in open or semi-open processes. An efficient cleaning procedure consists of a sequence of detergent and disinfectant applications at effective concentrations and correct temperatures and periods as well as of water rinses. A prolonged wetting exposure of the surfaces to the detergent makes the removal more efficient. The cleaning efficacy is also affected by the accessibility to and type of equipment cleaned. After cleaning the disinfectants kill the few microbes left on the surfaces. Residues of disinfectants must not be left on the process surfaces; they must be rinsed of the surfaces with water of potable quality.

Legal Requirements in Building Process Equipment

Alan Friis, Tech4Bizz, Denmark

In EU legislation constitutes the basic demands concerning hygienic design of food processing equipment. Since 1995 the Machinery Directive has been in place as the foundation document prescribing that equipment must be cleanable, materials smooth and free of imperfections and that it shall be possible to verify the hygiene status. Furthermore, a proper risk assessment must be conducted in order to address relevant risks towards the consumers. The Machinery Directive contains only general information thus it is supported by harmonized EU standards which deals with the specifics and are considered to demonstrate the current state technical state in the area covered by each standard. This will be covered in detail along with the EU legislation focusing on documentation and handling of food contact materials. The combined EU legislation in this field is a subject food producers and equipment manufactures alike must know about in order to fulfill legal demands and good stewardship in order to protect consumers against any hazard arising during production of food products.

Cleaning Technology in Controlled Rooms

Leila Kakko, Tampere University of Applied Sciences, Finland

Cleaning technology consists of the knowledge in proper and high quality cleaning. It should fulfill growing customers' demands. Cleanroom, controlled room, patient room, they all have different usage and even in cleanrooms all surfaces are contaminated with different kind of dirt, dust, microorganisms and condensed matter. To keep clean is to reduce any pathway ultimately transporting mass into the surface layers. Only two methods have been introduced for removing dust and dirt: ventilation and cleaning. Clean ventilation systems prevent the dust and dirt to accumulate on the surfaces. The criteria for what we want to obtain by cleaning differ: to obtain an acceptable perception, both visual and tactile, for hygienic and health concern reasons, and to prevent surface degradation.

Basic Criteria in Hygienic Design

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Hygienic site design principles are dealing with defences against both external and internal factory hazards. Detailed information on this can be obtained from the EHEDG Guidelines No. 44 "Hygienic design principles for food factories". At the building level there should be various barriers protecting the products produced from external, environmental and non-food manufacturing activities as well as internal activities e.g. maintenance. The external and internal structures should protect the process against pests, vermin, microbes as well as foreign bodies and chemical pollution. The space for the various process lines should be reserved at the planning stage. The Machinery Directive 2006/42/ EC (MD) states that surfaces in process equipment, which come into contact with foodstuff, pharmaceutical products and cosmetics, must be smooth without crevices and with as few projections as possible. The process lines must be accessible enabling cleaning and disinfection. The instructions for these machineries must contain information on recommended cleaning procedures and products. The CE-marking system, which deals with minimisation of safety related risks due to the use of the equipment, is also described in the MD. In the horizontal standard EN 1672-2 + A1:2009 there are principles, which can be applied to machineries and equipment used in food and feed processing. Detailed information on hygienic design (No. 8) of both closed (No. 10) and open (No. 13) equipment can be found in the EHEDG Guidelines.

Construction Materials in Food Equipment

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Construction materials intend to come in contact with food products should be inert to foods produces. This to the extent that there is no migration from the material to the food product that make either a noticeable alteration of the food product or endanger human health. Different classes of construction materials will be covered with the main focus being on the most common stainless steels, plastics and rubber for gaskets. The materials of cause need to be durable and withstand the continuous contact with the foods produced and also the cleaning agents applied. Thus, different grades of stainless steel will be covered and related to their corrosion resistance, for the plastics focus will be on migration and migration testing and for the rubbers the matter is compatibility with food products and life time in real processes. All in all a comprehensive guide to food contact materials is presented.