Biocontainment engineering for successful biosafety level 3 laboratories in Asia

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Marcel Fiocchi

PTM-Engineering GmbH Switzerland

FioTec (Thailand) Co., Ltd.

Stages of a typical BSL3 lab project

- Initiative by future Lab Owner
- Preliminary study
- Master study → Selection of Contractor(s)
- Detail engineering
- Construction, integration and assembly of equipment
- Technical documentation, Commissioning, Certification
- Operation of BSL3 lab
- Preventive maintenance, eventual yearly recertification

Preliminary study

- Decide on a committee of experts and a team leader
- Team leader selects external engineering consultant
- First discussion with engineering company → target
- Be certain at this stage what “standards” to be followed…
- Make a written report of this first discussion (Base)

Engineering company makes primary investigations:

- Enough room in existing building, building static etc
- Site investigations (soil, water, waste water, power, environment…)

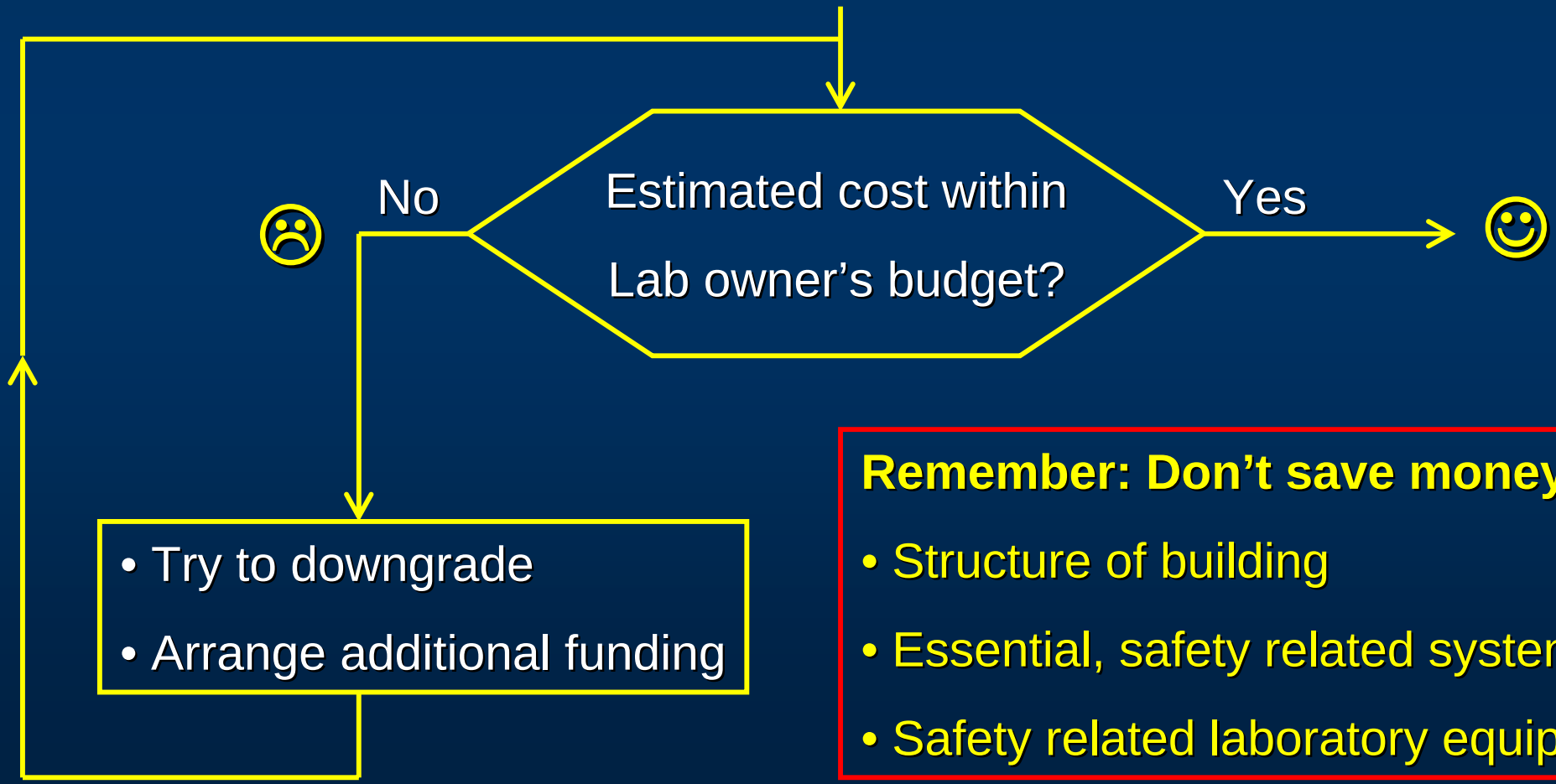
Preliminary study

Take up actual situation

Preliminary study

The engineering company works out a proposal:

- Cost estimate +/- 15% (In practice often difficult…)
- Layout proposal according to the Lab owner's wishes



Remember: Don't save money on:

- Structure of building
- Essential, safety related systems
- Safety related laboratory equipment

Preliminary study

Possible reasons for a project termination at this stage

Chances	Possible causes	Remedy
Big	➢ Budget shortage ➢ Poor cost-value ratio	➢ Design functional lab, omit luxury ➢ Analyze real needs ➢ Re-design within budget, avoid junk ➢ Fund raising, increase budget

Master study

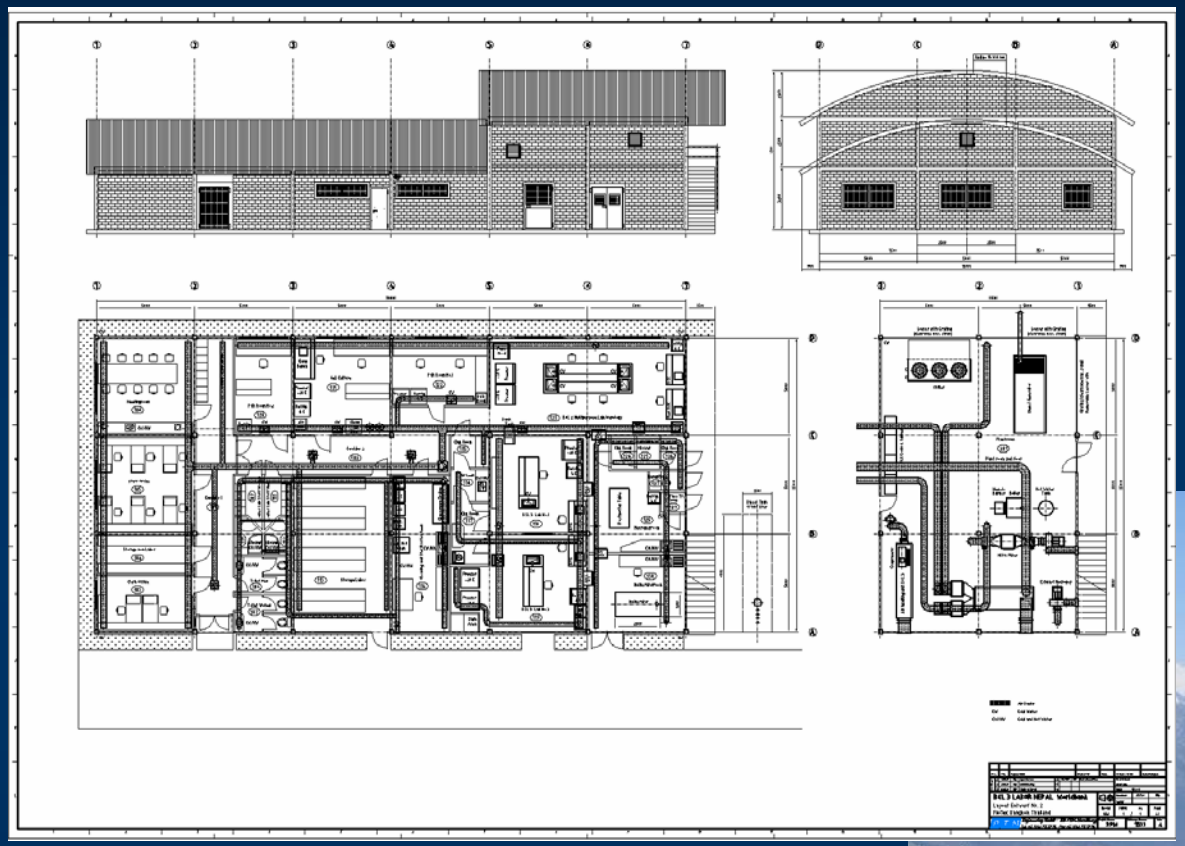
- BSL3 Team (Team leader) brings in last small changes
- Engineering consultant checks for feasibility and cost
- Make a written protocol

Engineering consultant reworks preliminary study and develops:

1. Detailed layouts and plans
2. Bill of Quantity = BOQ (And Abstract of Cost = ABS if Government)
3. Quotation with binding prices for the project (Or Tender Documents)

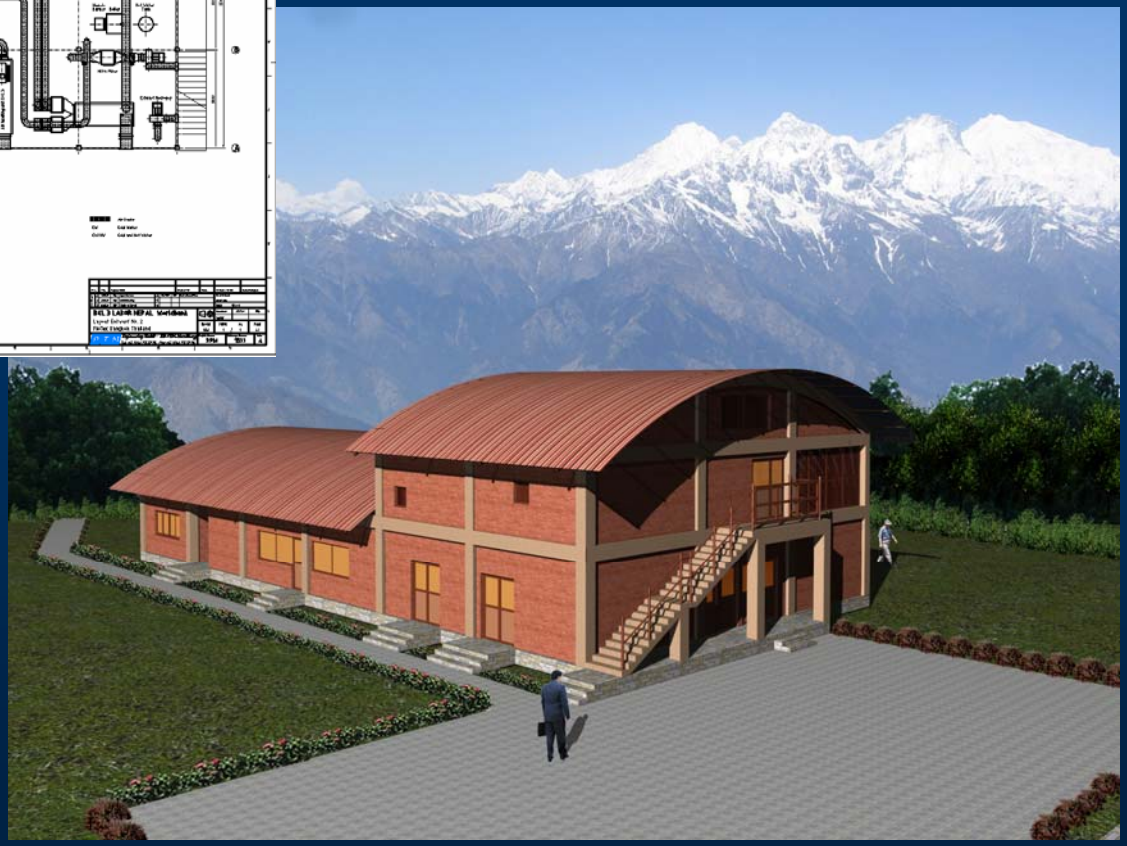
The Lab owner can now use those document to ask for quotes from potential contractors (or bidding)

Master study



Layout

Visualize



Master study

Next steps: The lab owner chooses an experienced and financially sound contractor (Create an evaluation scale)

- Look at the contractor's track record of successful completion
- Get references from the other projects
- If you are not confident to make those decisions, get help from your engineering consultant
- Do not forget to explain the lab work flow to the engineers

Master study

Possible reasons for a project termination at this stage

Chances	Possible causes	Remedy
Medium	➢ Too high complexity ➢ Project cost overrun	➢ Reduce size, facilities and functions ➢ Revise plans according to actual budget

… The stages “Preliminary Study” and “Master Study” are the most important steps for a successful BSL3 lab project…

- Now the decision is made how YOUR lab will work and how it will look like
- The BSL3 lab should be functional, not beautiful. This will increase workplace safety
- **Invest enough time in this planning phase, don’t rush things through in this phase**
- Do not accept any solution that you do not understand or that you are not comfortable with
- Be open to suggestions from your engineering consultant
- Discuss all remaining doubts with your consultant to the end, unclear und “forgotten” items cannot be implemented later easily or without high cost
- Do not accept “cheap” system components, those will take revenge later on with much higher cost

Detail engineering & Construction

It is advisable for larger projects to employ a project manager / quantity surveyor

Contractor starts with detail engineering work:

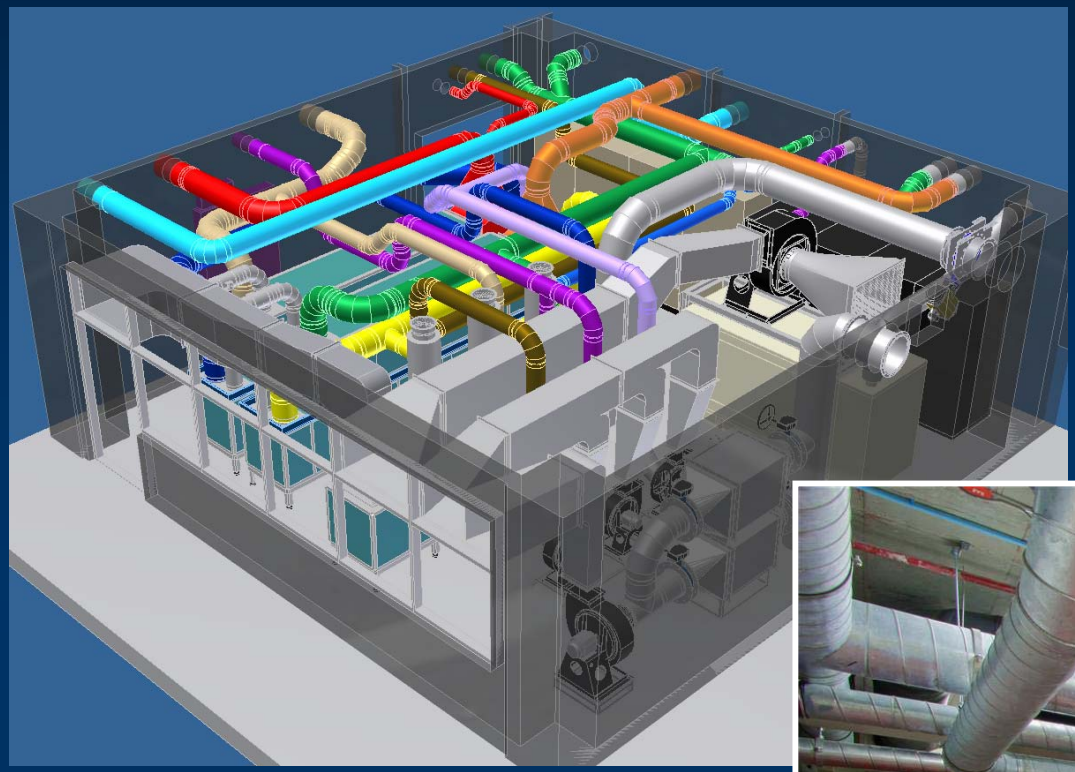
- Layout of lab rooms, plant room disposition plan etc…
- Shop drawings of specialized equipment, ducts
- Calculations for system components
- Coordination with subcontractors (AHU's, Autoclave etc…)

Check:
- Delivered materials
- Workmanship, quality of works on-site
- Maintenance friendly access of components…

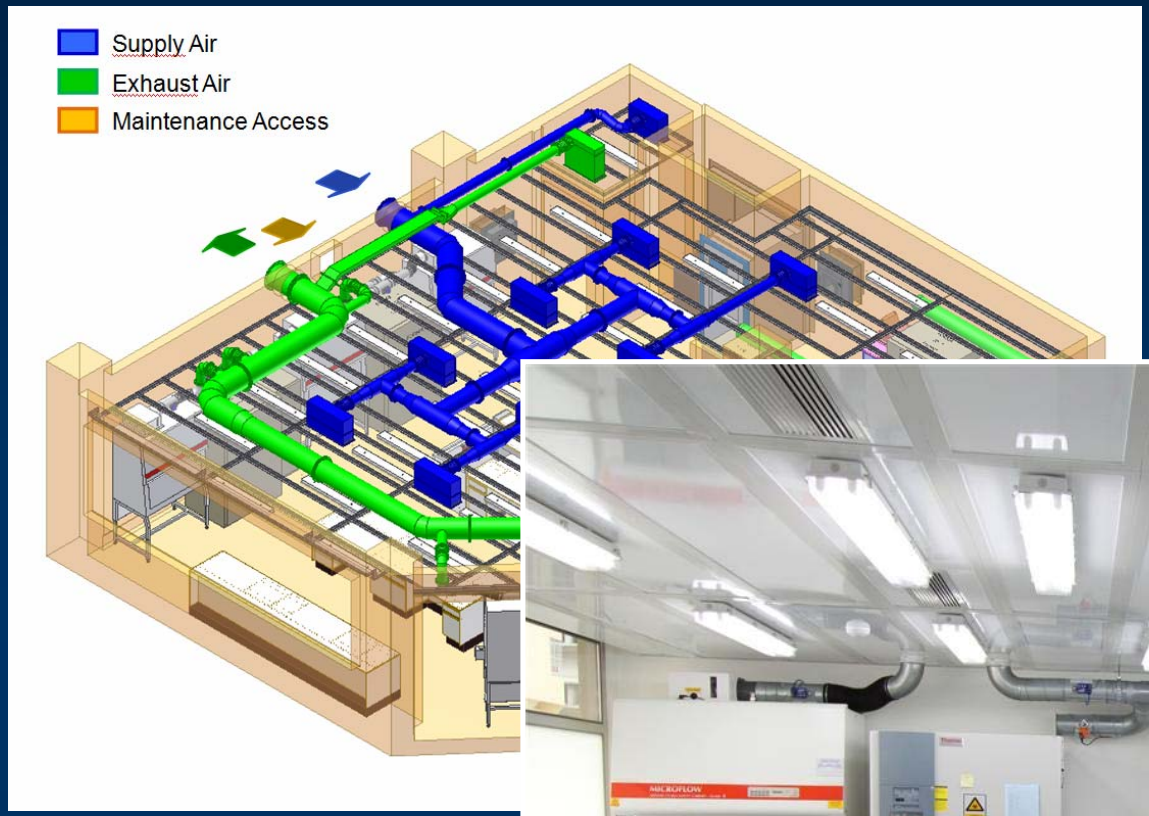
Detail engineering & Construction

Some examples…

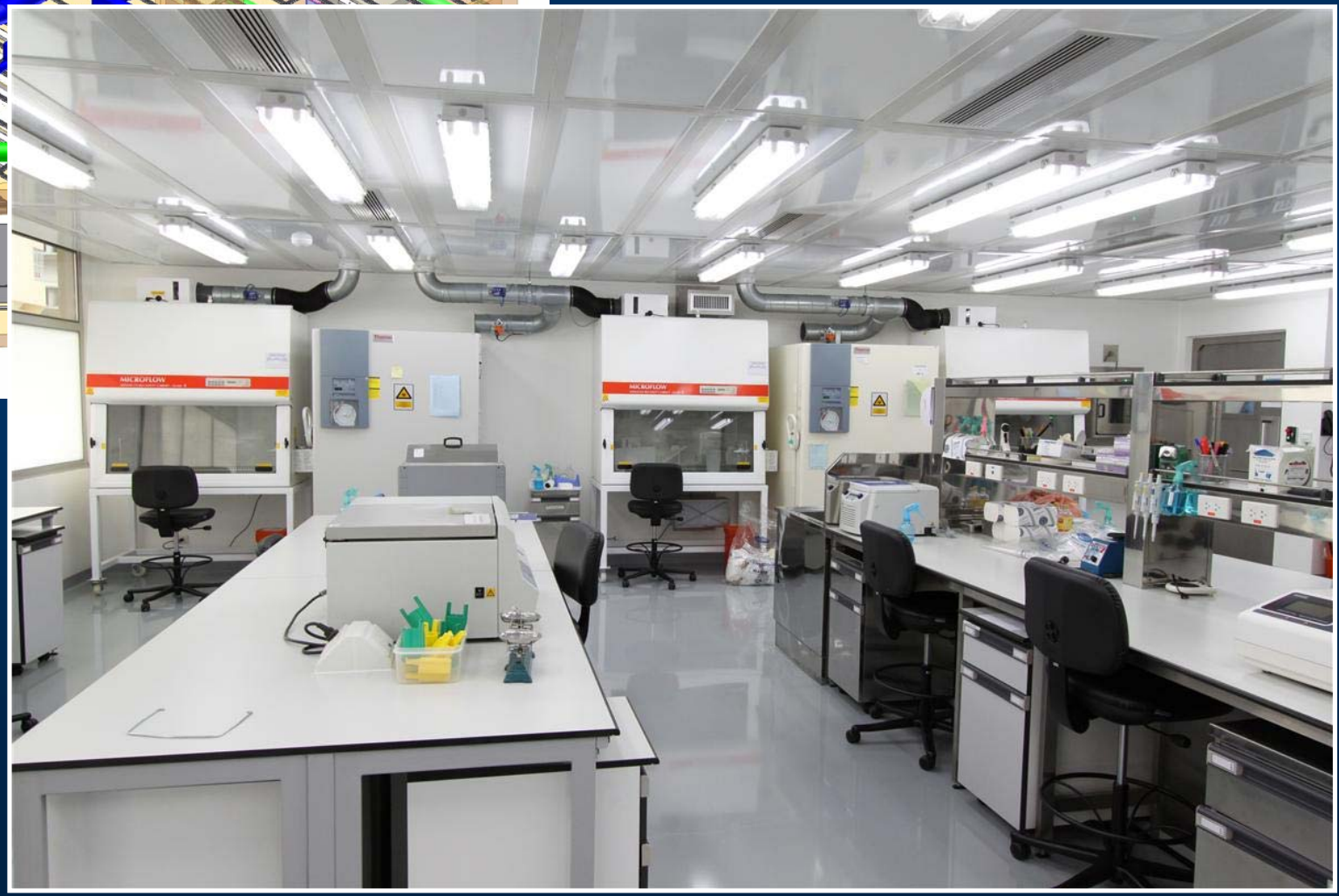
Detail engineering & Construction



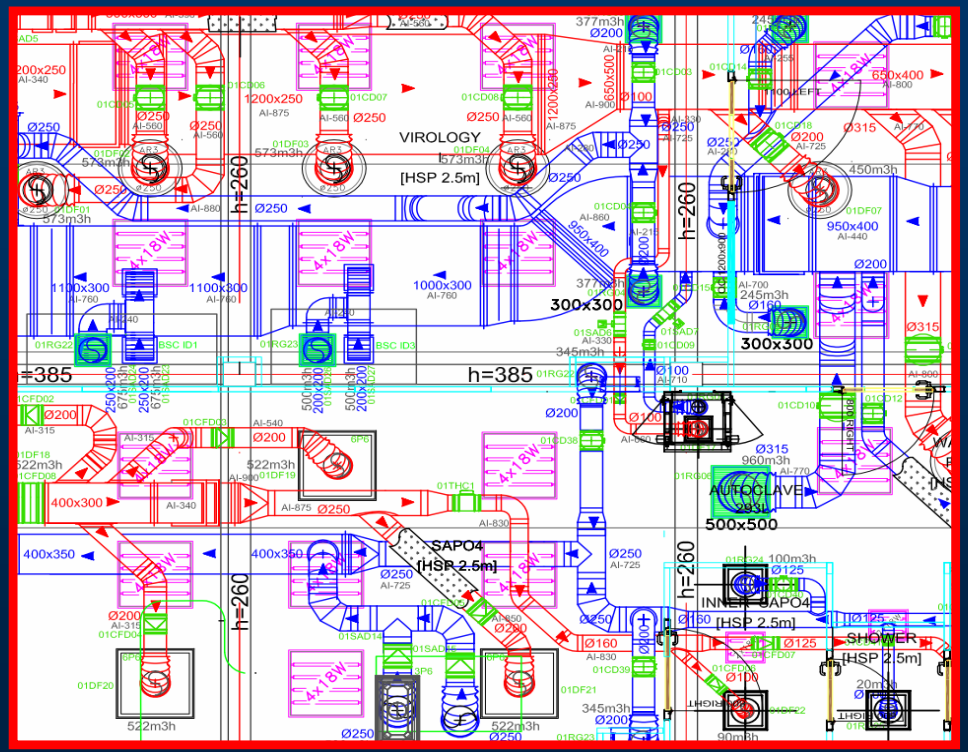
Detail engineering & Construction



BSL3 Laboratory



Detail engineering & Construction



Keep air handling systems simple

To increase system reliability…

Detail engineering & Construction

Detail engineering & Construction

Possible reasons for a project termination at this stage

Detail engineering…

Chances	Possible causes	Remedy
Very small	➢ Cannot technically realize ➢ Contractor skills not sufficient	➢ Find alternative solutions…

Construction…

Chances	Possible causes	Remedy
Medium	➢ Political decisions ➢ Budget overruns ➢ Problems with suppliers or contractors	➢ Financial and technical controlling!

Technical Documentation

- A comprehensive Technical manual as well as a maintenance manual are important deliverables by the contractor!!
- Technical training for technical maintenance personnel of BSL3 lab must be done by the Contractor

Commissioning, Certification

- Commissioning by commissioning agent (engineering consultant) or contractor together with Lab owner
- Certification by external independent certification agent according to the “standard” defined in the preliminary study

If all went well…

Grand Opening!

↓

Operation of BSL3 lab

Commissioning, Certification

Possible reasons for a project termination at this stage

Chances	Possible causes	Remedy
Small	➢ Technical deficiencies in buildings, systems ➢ Not fulfilling of technical standards	➢ Proper contractor ➢ Bank guarantee! ➢ Professional staff

Preventive maintenance

- Strictly follow Maintenance manual
- Yearly maintenance contract for all technical systems and laboratory equipment…
- Spare part kit
- Yearly re-certification of facility

Happy research!

End

Preventive maintenance

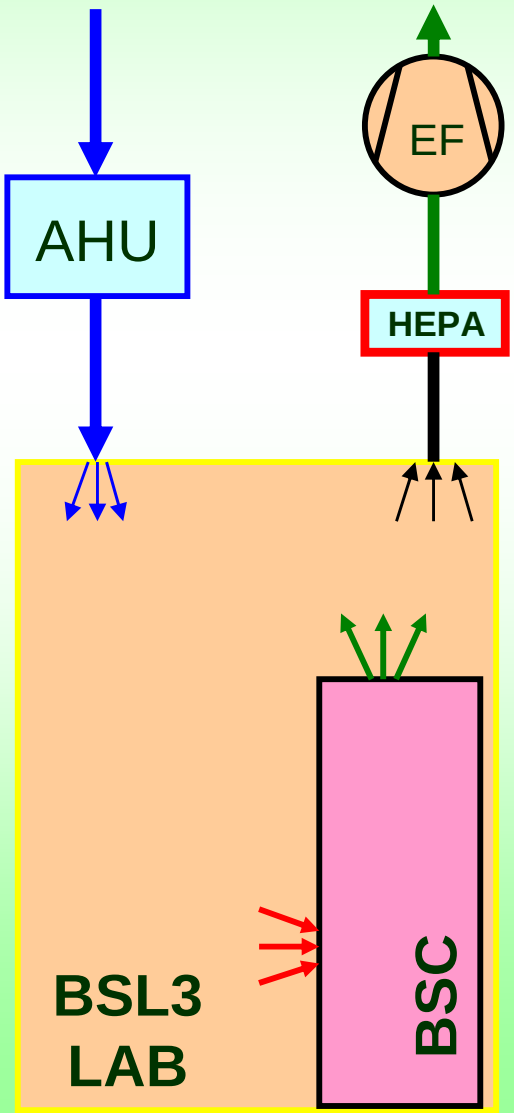
Possible reasons for a project termination at this stage

Chances	Possible causes	Remedy
Very small	➢ Too little budget for maintenance, running cost of laboratory and equipment	➢ Keep facility maintained and certified ➢ Develop a budget for running cost and maintenance

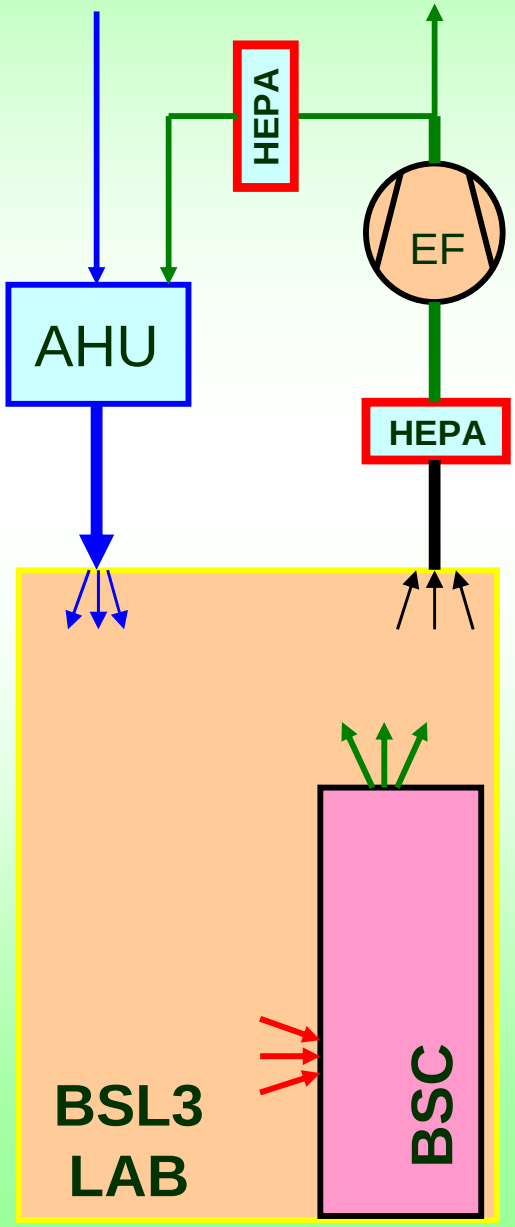
END...

Energy conservation? (some thoughts)

Now…



Future??...



Thank you

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