Challenges in Establishing Laboratories in Developing Countries

Murphey’s Law or Pitfalls & lessons learned

TOPICS AGENDA

(A) Projects and their constraints
(B) New construction or major refurbishment
(C) The laboratory design process
(D) Laboratory engineering
(E) Material selection and quality control
(F) Supervision of construction
(G) Commissioning of construction and engineering
(H) Installation and commissioning of equipment

Projects worldwide …

Common constraints …

- developing countries usually are recipients of technical and/or financial aid, but the use of foreign aid funds often restricted to equipment and training; not usable for major construction therefore countries -apart from their obligation to provide the land- often have to bear also the cost of construction with the limited resources they have

A frequent situation: …

“no funds for construction …but may be an existing (usually an old) building that could be made available”
**Major refurbishment or new construction ?!?**

- Most who have gone through such process know what a headache it can be to renovate or refurbish and try to convert an old building into a modern laboratory.
- One should also be aware that at the end of the process a major refurbishment may turn out to be more expensive than a new construction.
- In any case: look at what is the general construction environment and experience in the country including what kind of materials are available locally.

**The laboratory design process**

- **Design team** (lab owner, lab users, lab specialists, engineers, architect, etc).
- **Design strategy** [tasks, area required (quantitative), area specification (qualitative), area logistics, engineering, architecture, planning, interior design, implementation & supervision).
- **Not a straightforward** process – requires repeated coordination and synchronization with the user and other members of the design team (development of draft proposals, choice of best option, master plan for larger projects).

**Laboratory engineering …**

- **Electricity** > unstable, frequent interruptions, scheduled power cuts
- **Water** > shortages, scheduled supplies, low pressure
- **Gas** > laboratory gases usually need to be imported
- **Air management** > an unknown or unfamiliar concept (for labs)
- **Laboratory safety** > severely neglected

**Electricity problems …**

- **Electricity** problems often
- Fluctuating voltages
- 140 - 290 V
- **“Easy fuses”** …
- Overloaded and malfunctioning voltage stabilizers

**Special practices**
Water supply problems …

Water: > shortages, scheduled supplies, low pressure

Laboratory gas supply … central/ local

Gas > laboratory gases usually need to be imported (expensive)

Alternative:

… gas generators

Service?

Gas supply by rickshaw

Laboratory air management

- air circulation / air exchanges
- replacement of exhausted air
- pre-conditioning of incoming air
- cost factor usually underestimated

Material selection and quality control …

- Tendency to buy the cheapest materials
- Quality control becomes a must
- Examples > windows, metallic items (SS), plastic ware, electric sockets, etc

Material selection and quality control …

T > 180°C
Supervision of construction or refurbishment …

> task of the supervising engineer!?

- Positioning of windows and doors
- Door sizes (width, height, direction of opening)
- Positioning of electric sockets
- Electric wiring and circuit breakers
- …

Commissioning of construction and engineering …

… another couple of surprises …

- Electric wiring, safety, CBs, earthing
- Gas and water supply
- Air-conditioning
- Fume hoods
- Power generators

>>> two examples >>>

Air-conditioning & ventilation

- performance checks
- temperature / humidity / time
- Exhaust volumes & face velocity
- Pressure difference (inside / outside)

Air-conditioning & ventilation

Problem: room not equally cooled

Air-conditioning & ventilation

Problem: ACU failed

- Rat damage: eaten up the T sensor cable
- Problem: no exhaust … unsuitable duct material

Power generators …
Power generators …

Installation and commissioning of equipment …

- receiving, checking & positioning
- electrical connections
- performance tests
- operator training (usually software driven)
- qualification of local engineers

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Test gear useful for commissioning

- DMM
- Clamp meter
- Recording devices
- Water pressure indicator
- Anemometer
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May be the biggest challenge is …

Finding people that are …

- Dedicated
- Greatly motivated
- Willing to read & learn more
- And all this for a salary of 100-200 USD
- a month …

Think about it ….