Renovation and upgrading manufacturing facilities

Lessons learned - Practical experience with fabric/finishes, HVAC systems, utilities, and automation

Gordon Farquharson
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PharmOut
Regulatory Knowledge, Practically Applied.

Agenda

1. Fabric and finishes.
2. HVAC.
3. Utilities.
4. Automation systems.
5. Conclusions.

Introduction

Typical examples of renovation work triggered by new cross-contamination requirements:

- Adding secure filtration to existing recirculation AHU.
- Adding airlocks.
- Upgrading dust extraction system.
- Adding vacuum cleaning system.
- Closing processes:
  - New process equipment.
  - Adding isolators.

1. Fabric and finishes

Investigating fabric and finishes:

- Apparent surface damage easy to determine.
- Dig deeper to find rust and contamination problems.

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Not as we had hoped
(new sockets, existing wall panel)

Quality problems

Fabric and finish:

- Regret decision to retain existing pre-fabricated.
- Looks tired, difficult to improve.
- Cause of problem:
  - False economy to save money.
  - Inadequate investigation of condition.
- Difficult to rectify quickly if a problem is found.

2. HVAC

Contamination in duct

Poorly documented 2D design

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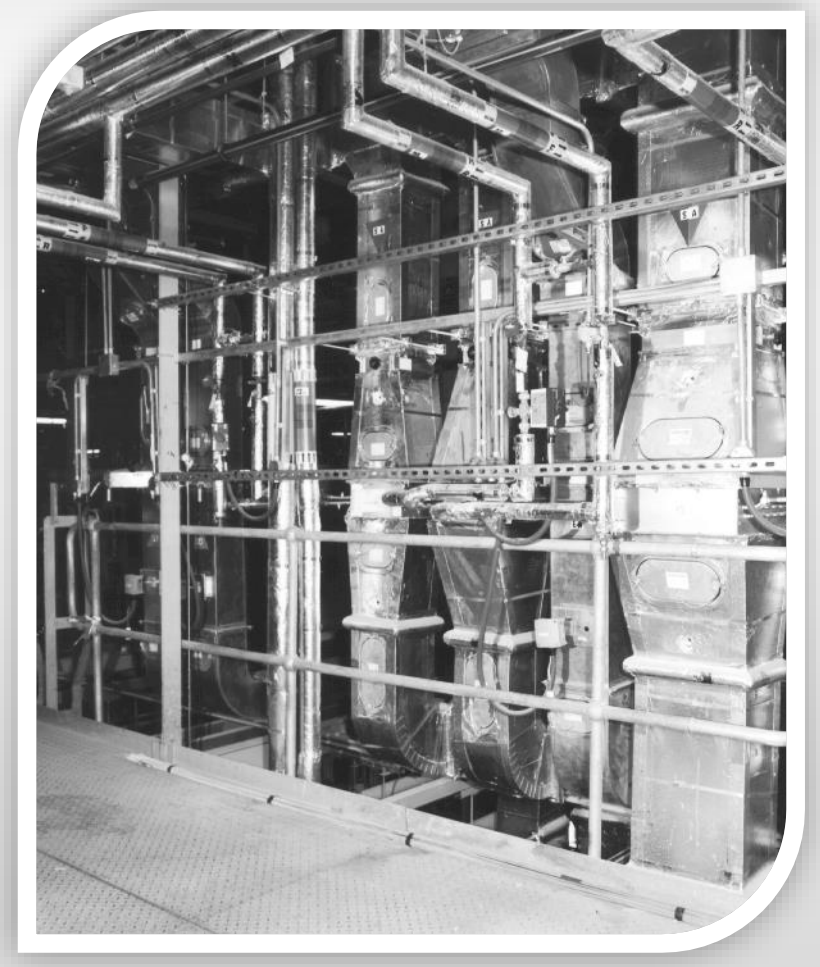
Access problems
"I knew that actuator would be a problem !"



OOPS, nowhere to go !

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Clashes and conflicts

Greater risk of this in a renovation when existing systems are retained:

- Components clash – fabric, HVAC ducts, utilities.
- Looked ok on paper.

Cause of problem:

1. Inadequate documentation of existing.
2. Inadequate co-ordination of new work.
3. Unclear responsibilities.

Difficult to rectify quickly if a problem is found. Just have to spend the time and money to work around and manage the inevitable compromises.

You can fit it in if you are careful

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Temporary HVAC systems

- Temp chilled water quite easy.
- Temp AHUs more tricky but OK if you have space.
- Hooking up the ducts and balancing the system is the tricky bit.

3. Utilities

Critical utilities (Pharma water systems in particular)

Problem: Find that the theoretical maximum simultaneous demand draw-off of water is not possible.

- Original use was OK / New use is not.

Cause of problem:

- Original design not tested to limit.
- Not stress tested as part of renovation.
- Extension of system during renovation not adequately evaluated.
- Difficult to rectify quickly if a problem is found.

Capacity problems

Critical utilities (compressed air)

Problem: Find that the theoretical maximum simultaneous demand draw-off of water is not possible.

- Original use was OK / New use is not.

Cause of problem:

- Original design not tested to limit.
- Not stress tested as part of renovation (difficult to do).
- Excessive leakage not found during condition survey.

Relatively easy to rectify quickly if a problem is found.

Capacity problems

Energy utilities (chilled water, steam)

Problem: Find inadequate capacity for renovated facility.

Cause of problem:

- Can be difficult to evaluate spare capacity of a system that has evolved over 20-25 years.
- Poor data on maximum demand. (plan ahead and try to obtain this data during summer before renovation project starts.
- Not practical to do simulated load tests on an operating facility.
- Likely to have much better existing data if an energy monitoring and saving programme has been in place.
- Difficult to extend quickly if a problem is found.

Capacity problems

Energy utilities (electrical)

Problem: Find inadequate capacity for renovated facility.

- Rare because electrical load is relatively easy to measure.
- Likely to have good existing data if an energy monitoring and saving programme has been in place.

Cause of problem:

- on distribution system not in right locations.
- Incorrect evaluation of new load.
- Load centres relatively easy to extend quickly if a problem is found.

4. Automation systems

Problems with BMS, PLC & SCADA systems

Problem: Extended or adapted system fails to operate as expected. Quite common.

Cause of problem:

- Original functionality not tested before start of work.
- Sensors and actuators to functioning correctly.
- System fixes mean system is out of tune
  - Set-point off-sets.
  - Incorrectly tuned PID control loops.
- Relatively easy to rectify, but can cause delay at end of job.

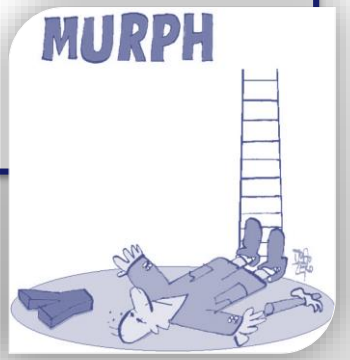
Conclusion

My top memories – things that went wrong!

- Insufficient survey work – being persuaded the "as installed" drawings were OK.
- Find hidden building structure problems:
  - Additional steelwork beams added.
  - Structural faults not recorded anywhere.
- Not enough chilled water for the renovated plant.
- Vibration causing contamination problems (spore release from gypsum plaster).
- Discovered existing AHUs for HVAC had not bottom – rusted away.
  - Performance data ok.
  - Inadequate detailed inspection.
- Conflicts between the works and on-going manufacturing operations. (Accidental interruption of critical systems).
- Took longer than planned.

Final thoughts

1. Things go wrong (Murphy's Law).
2. There is nothing like experience!
3. Be prepared, have a sensible contingency in hand (time and cash).
4. Preparation (investigation and testing) is essential.
5. Upgrade documentation on the systems and installations you want to preserve as part of the project.
   - Often inadequate budget allowed for this (money and time).
6. Renovation projects have the potential to generate a high level of tension and conflicts
   – time, cost, interruption to operations.



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Thank you for your time.
Questions?

Gordon Farquharson
Executive Consultant

gordon.farquharson@pharmout.net
www.pharmout.net