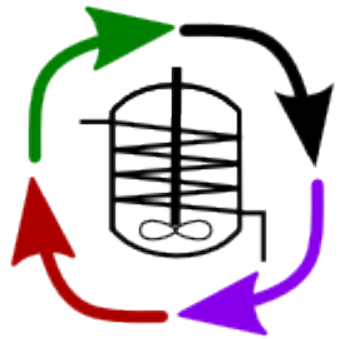
Engineering Economics and Problem Solving

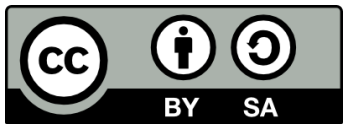
ChE 4N4



kevin.dunn@mcmaster.ca
http://learnche.mcmaster.ca/4N4

Revision: 33 (December 2013)

Copyright, sharing, and attribution notice



We appreciate:

- if you let us know about **any errors** in the slides
- **any suggestions to improve the notes**

All of the above can be done by writing to

`kevin.dunn@mcmaster.ca`

or anonymous messages can be sent to Kevin Dunn at

http://learnche.mcmaster.ca/feedback-questions

If reporting errors/updates, please quote the current revision number: 33

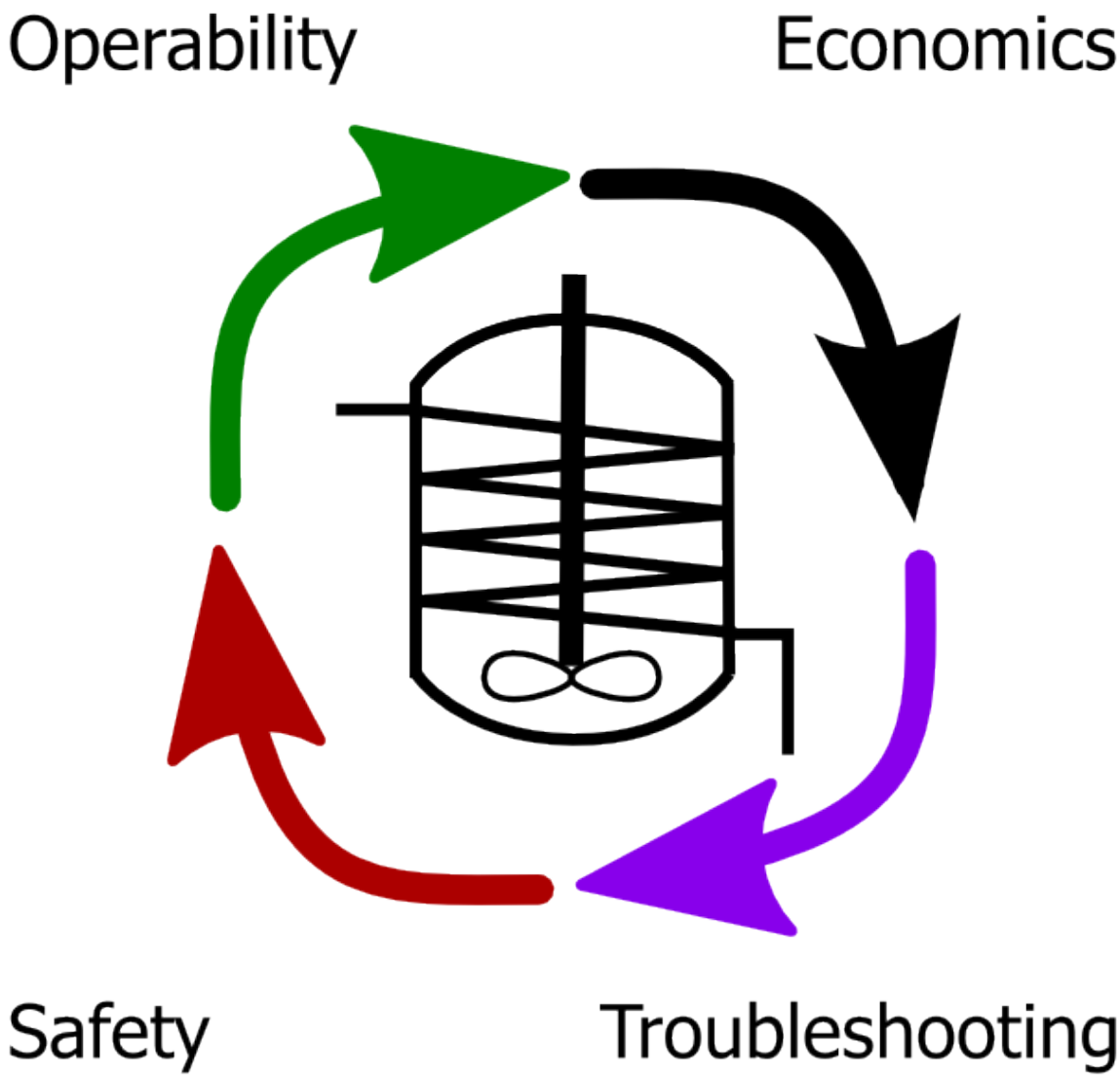
Special thanks to the TAs

- Danielle Maitland
- Chris Ewaschuk

Administrative

1. Course evaluations due: https://evals.mcmaster.ca
2. Peer evaluation & course reflection: *see course website*
   - Link will be posted by Friday
   - Due date will be after the exam, on 13 December.
   - Weight is worth 5% of the course grade

Main topics covered in 4N4



This is a unique course: not taught anywhere else.

What you've learned ...

You are capable of more than you thought.

- Constant exposure to the material via assignments helped you learn
- Surprised at how previous courses were brought together
- Improved your presentation and writing skills
- Can't do all the work yourself
- Some realized that "this" isn't for them

Life-long learning / Self-directed learning

- Challenging; felt you were without guidance
- Open-ended assignments and projects were a challenge
- Forced to use group-work to complete them in time
- You've become good at locating information required
- Sorting out "what's necessary" from "nice-to-have"
- Become more efficient at managing your time

SDL after 4N04

You will keep learning:

- from the plant
- running experiments
- talking with experts
- website
- company-sponsored courses, seminars and conferences
- reading books, journal publications, trade journals

What's in the exam

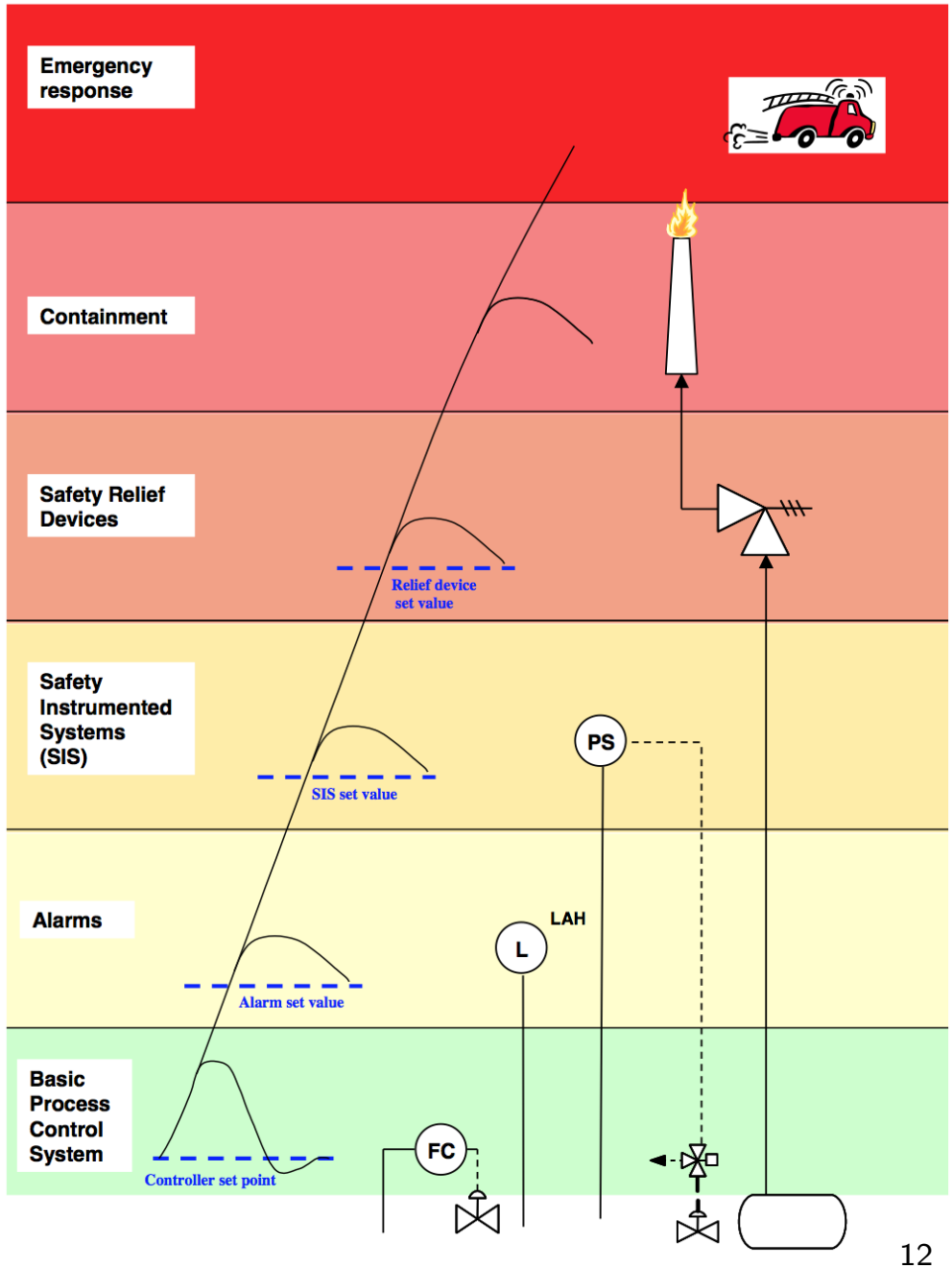
1. Engineering Economics
2. Process Safety
3. Operability
4. Troubleshooting
5. Engineering Professionalism and Ethics
6. Everything covered in tutorials, assignments and class

Economics: what we covered

1. Personal finance
2. Cash flows
3. Time value of money $F_n = \dfrac{C_n}{(1+i)^n}$
4. Profitability estimation: payback time; for independent projects we required DCFRR $\geq$ MARR and NPV ≥ 0
5. Tax and depreciation: **always taken into account**
6. Sensitivity analysis
7. Capital and operating cost estimation
8. Bring the list of CRA classes and CEPCI cost indices to the exam

Process Safety

1. Hierarchy
   - 1.1 BPCS
   - 1.2 Alarms
   - 1.3 SIS
   - 1.4 Relief
   - 1.5 Containment
   - 1.6 Emergency response
2. Preliminary analysis (checklists/relative ranking)
3. HAZOP: nodes, parameters and guidewords
4. Case study: BP in Texas City



Operability

Recognize the plant must still operate under conditions, and in situations, different to what it was designed for.

1. **Operating window** at steady state
2. **Flexibility** and controllability: degrees of freedom; what's manipulated? what's controlled?
3. **Reliability**: parallel and series structures; duplicate units
4. **Efficiency**: heat integration, recycle, different power sources
5. **Transitions**: maintenance, start-up and shut-down, regeneration, and grade changes. Bypass, batch-continuous interfaces; storage.

Troubleshooting

1. *I want to and I can!*
2. **Define**: what is and isn't, where, when, who, what
3. **Explore**: fundamentals, important variables, cause-and-effect
4. **Plan and diagnose**: root causes in a table, collect evidence, initiate diagnostic experiments (actions)
5. **Implement**: short-term and long-term solutions
6. **Look back**: reflection ... what worked and what didn't

Bring the handouts from Dr Marlin (also available on website)

Professionalism and Ethics

- The material we covered in class
- The material posted on the course website
- Bring the Code of Ethics sheet to the exam

Final exam

- 06 December 2013 at 12:30
- IWC-3
- Printed materials (textbooks, any papers, etc.) are allowed
- Any calculator is allowed
- Pencil is OK, as long as it is dark
- Answer questions in any order
- Please use bullet points to answer
- Never repeat the question back in your answer
- Something is unclear, or seems incomplete, make a *reasonable assumption* and continue with the question.

Preparing for the exam:

- Please read Dr. Marlin's notes (not just slides, the notes)
  - Safety
  - Operability
  - Troubleshooting
- Please review the slides, videos and material covered in class

Thank you

- For your feedback via the mid-term evaluations and anonymous evaluations
- Many changes proposed from 2012 were implemented in 2013
- **Thank you for being a great class to teach.** See you in 4C3.

4W04 — Bring it on! I'm ready!