

APSC 101 Study Notes

Intro to Engineering II

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1. Professional Skills / Working in a team

1.1. Tuckerman's Stage of Development

Tuckerman's Stages of Development: Forming, Storming, Norming, Performing

Tuckman's Stages of Team Development



1.1.1. Important Notes

- relationships within members get BETTER over time
 - this includes storming, as team members are more willing to speak their minds
- conflict occurs at all stages

1.1.2. Good vs Bad Norming

- Good norming is healthy
- Bad norming → team dysfunction
 - e.g. one team member routinely misses meetings and team does nothing

1.2. Conflict Management

Conflict Management Styles



Avoiding: Good when tensions high.

Accommodating: Good when the issue matters more to the other party.

Competing: Good when issue is self-critical and immediate.

Compromising: Good if time is short and relationships/problem must be balanced.

Collaborating: When you have time to work towards finding the ideal solution for everyone.

Good teams change their style as situation demands.

1.3. Equity Diversity Inclusion (EDI)

Equity: Everyone has same opportunities and outcomes

Diversity: recognizing and valuing different background, identity, experiences, and different points of view

1.4. Biases

Implicit biases: subconscious stereotypes about groups, learned through what we see

Microaggressions: small, subtle, or indirect discriminatory actions or statements

Stereotype threat: when people feel concerned about conforming to a stereotype for a group they belong to

Allyship: acting to support those facing discrimination in or underrepresented groups

- Reactive allyship: in response to an incident of bias (e.g. team member steps in to defend another)
- Proactive allyship: when someone actively engages to make marginalised individuals feel more included and respected

1.5. 5 Keys to an effective team

- **Dependability**
- **Structure & clarity**
- **Meaning**
- **Impact**
- **Psychological safety** *[most important]*

Does not depend on skills of team members.

2. Risk Management

$\text{Risk} = \text{Severity} \times \text{Likelihood}$

$\text{Risk} \neq \text{Hazard}$

Risk: *Possibility* of harm, consequences, or damage.

Hazard: *Capacity* of equipment, material, or processes to cause harm.

2.1. Risk Sources

Preventable: Controllable.

General time management issues included, such as not anticipating delays.

Strategic: Taken for possibility of greater reward.

For example, rushing through decision making stages for earlier project completion, this is a strategic risk, not preventable.

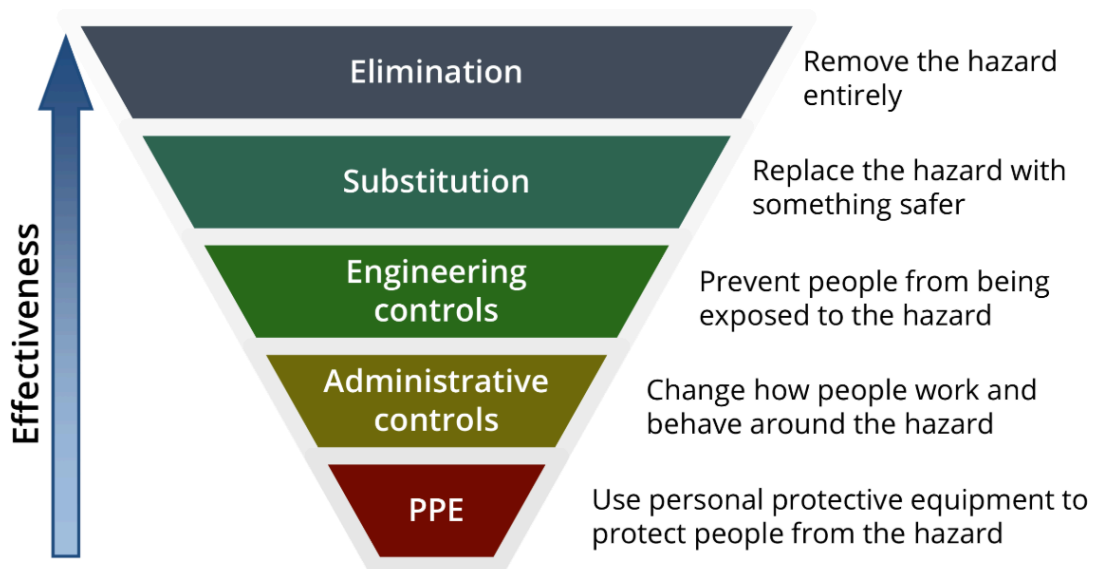
External: Outside of control.

2.1.1. Risk vs Hazard

Risk: possibility of harm, consequences, or damage

Hazard: capacity of equipment, material, or processes to cause harm

2.1.2. Control Hierarchy for Safety Hazards



3. Drawings (tbd)

4. Feedback

4.1. 7 Cs (recap)

Clear - easy to follow, easy to understand

Correct - Factually accurate, prepared according to professional standard

Concise - Brief, efficient

Concrete - Detailed, vivid, and specific. Main point is clearly evident

Complete - includes info relevant to the audience, conveys what audience should do

Courteous - polite and respectful, genuine and sincere

Considerate - empathetic and mindful, prepared with receiver in mind

4.2. 3x3 Feedback Model

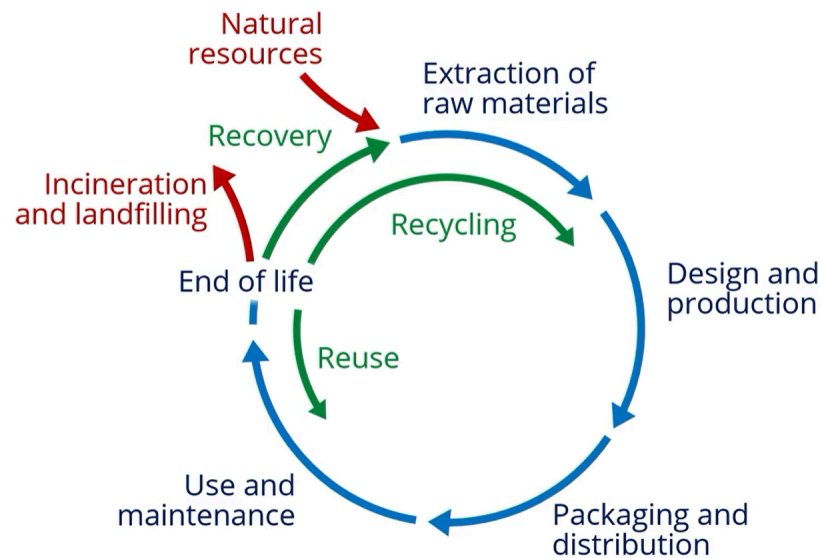
Sender	Message	Receiver
Clear consistent, unambiguous speech and body language	Concrete descriptive, specific, and non-judgmental; focuses on receiver	Clear consistent, unambiguous speech and body language
Courteous polite and respectful tone, language, and body language	Complete includes observations, impacts, suggestions, and follow up	Courteous receptive; polite and respectful tone, language, and body language
Considerate time and method of feedback considers the receiver	Considerate is empathetic and relevant to the receiver	Complete acknowledge the feedback; ask for clarification

5. Systems Thinking (covered in APSC100, will be tested again in 101)

6. Life Cycle Thinking

Life cycle thinking: accounting for all impacts of a product or process across all stages of its life cycle

6.1. Life Cycle Stages



At product end of life, the following options are ranked most desirable to least desirable

1. **Reuse:** reuse the product in its current state, upcycle unwanted products to products of higher quality or value, or repurpose the product to a new use
2. **Recycle:** process the raw materials in the product and produce something new
3. **Recovery:** extracting as much energy or material from product as possible before disposing of it

Another is **reduce**, which is to change behaviours as a society to reduce what we consume and use.

6.2. Life Cycle Assessment (LCA)

- systematic evaluation of the impacts of energy and material inputs and outputs for a product/process across all life cycle stages

1. Goal Definition and Scope

- System boundary: a description of what elements are included or not included in an LCA
- Functional units: a reference measure of performance to use as a baseline in comparing options

Possible functional unit: 100 million lumen-hours of light



	Incandescent	CFL	LED
Life (hrs)	1,000	8,500	50,000
Brightness (lumens)	900	900	800
Number of bulbs*	111.1	13.1	2.5

*100 million lumen-hours

1. Inventory Analysis

2. Impact Assessment

- impacts of each material and energy flow are quantified

3. Interpretation

- systematically review work of each stage as new information comes in

6.2.1. Challenges with LCA

- Detailed knowledge of material and energy flows required
- Impacts must be known and quantified
- Focuses on environmental impacts
- *difficult to use early in design process*

6.3. Risk Tools

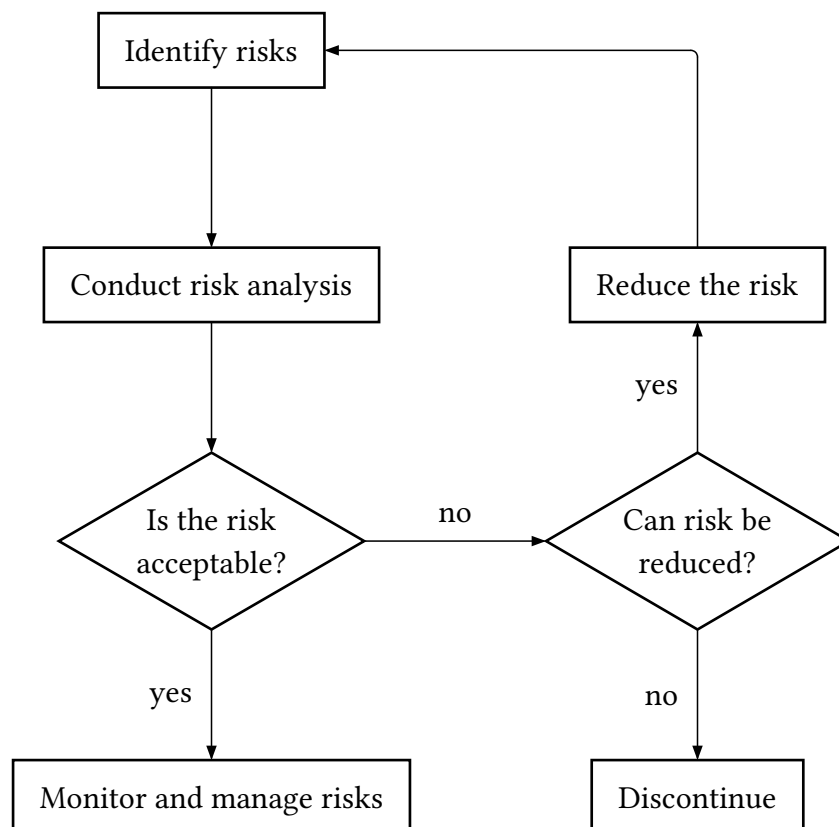


Figure 1: Risk Management Process

		RISK SOURCE		
		Preventable	Strategic	External
RISK CATEGORY	Safety		N/A	
	Technical			
	Project Management			
	Operational			

Table 1: Risk Classification Table

A risk classification table is a tool used to identify and classify risks based on their severity and likelihood.

		SEVERITY				
		1	2	3	4	5
LIKELIHOOD	5					
	4					
	3					
	2					
	1					

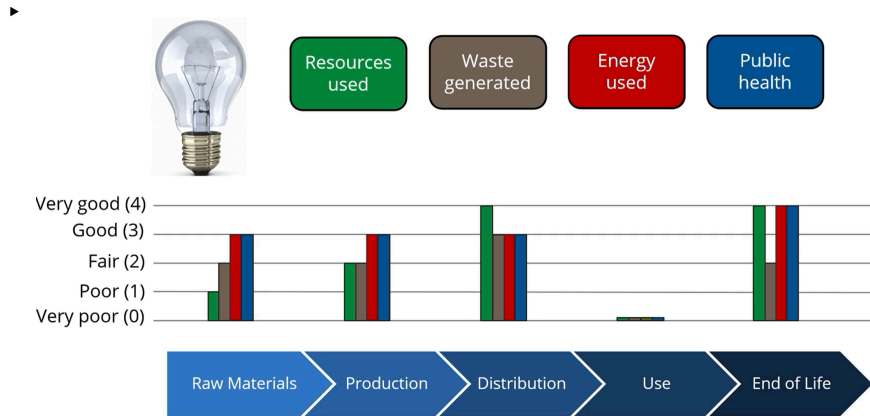
Table 2: Risk Matrix

ID	DESCRIPTION	SEVERITY	LIKELIHOOD	RATING	MITIGATION
1					
2					
3					

Table 3: Risk Register

6.4. Streamlined Life Cycle Assessment (SLCA)

- for each criterion and for each life cycle stage, evaluate performance of product/process on a qualitative scale
 - e.g. “very poor” to “very good” or “significant negative impact” to “significant benefit”



- results usually tabulated in SLCA Matrix

►

Life Stage	Raw materials	Production	Distribution	Use	End of life
Resources used	1	2	4	0	4
Waste generated	2	2	3	0	2
Energy used	3	2	3	0	4
Public health	3	3	3	0	4

- values in matrix then summed to determined environmentally responsible product rating (R_{ERP})
 - equivalent to score in WDM if all weights were 1

6.4.1. Usage of SLCA

1. use R_{ERP} to benchmark performance against other products
2. use SLCA ratings to determine areas of greatest negative impact

6.4.2. Benefits of SLCA

- SLCA faster, easier, less expensive to complete
 - SLCA takes days, LCA can take months
- SLCA qualitative (easier to use with criteria which are more difficult to quantify), but also makes results **less precise**
- SLCA suitable for any stage of design process (especially early where potential influence on design decisions is greatest)
 - LCA suitable for existing products / very late in design process (where precise assessment of impact is required)