





SOLID WASTE Management

5R'S

CONCEPT

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SOLID WASTE MANAGEMENT: 5R'S CONCEPT

POLITEKNIK TUANKU SULTANAH BAHIYAH



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Thank you all for being a part of this journey. This e-book is a product of our collective effort and belief in the power of words and ideas.



PREFACE

In a world marked by ever-expanding consumption and the relentless pursuit of progress, the issue of waste has taken center stage. From overflowing landfills to polluted oceans, the consequences of our throw away culture have become impossible to ignore. Recycling, once a fringe idea, has now emerged as a critical solution to the environmental challenges we face.

The importance of waste reduction, the power of individual actions, and the innovations that are transforming the recycling landscape are all subjects we'll explore. As we take this deep dive into the realm of recycling, my hope is that you, the reader, will be inspired and empowered to make sustainable choices in your daily life, as well as to advocate for positive change in your community.

Recycling is not just about managing waste; it is about transforming our society's relationship with resources and our environment. It's about recognizing the inter connectedness of all living things on this precious planet we call home.

This e-book is a small contribution to a collective effort to preserve and protect our world for generations to come.

Nurhuda Ismail Ts. Noor Azalina Khalil Ts. Zarina Syuhaida Shaarani

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5R'S CONCEPT



5 R's, five actions should be taken, if possible, prior to 'recycling': refuse, reduce, reuse, recycle, and then ROT. Incorporating this methodology into your business' waste reduction and recycling efforts will minimize landfill waste and help take your recycling program to the next level

WHY ARE THE 5R'S IMPORTANT?

Refuse, Reduce, Reuse, Recycle and ROT are also known as "the most important 5R's" of waste management. The concept of 5R's is to decrease the amount of things we use and simultaneously also decrease the amount of things we throw away.



RO STE

K

5R'S CONCEPT



HIERARCHY OF 5R

REFUSE

REDUCE

REUSE

RECYCLE

ROT

5R'S CONCEPT











Refuse: the first element of the 5 R's hierarchy. Learning to refuse waste can take some practice, but incorporating this step into your business' strategy is the most effective way to minimize waste. Talk to your procurement team about refusing to buy wasteful or non-recyclable products.

When working with vendors, refuse unnecessary product packaging and request reusable or returnable containers. Making smarter purchasing decisions and setting standards and expectations early in the process makes it easier for organizations to "refuse" waste in the first place.

This is the first step. Refusing materials is the primary way to lower our impact on the landfill. Try to refuse single use plastics – packaging, bags and straws – take alternatives with you.

Here are some ways you can do this:

- Carry a reusable bag in your car and/or bag.
- Carry a water bottle and hot drink reusable cup and a jar for cold drinks.
- Avoid unnecessary product packaging and request reusable or returnable containers.
- Make smarter purchasing decisions.





'Refuse' is the most effective way to minimize waste.

How?

Refuse to buy wasteful or non-recyclable products, refuse unnecessary product packaging and request for reusable or returnable containers, making smarter purchasing decisions and setting standards and expectations early in the purchasing process makes it easier for organizations to "refuse" waste in the first place.



REDUCE

DIICE WILL TRY TO REDUCE MY PLASTIC WASTE & BUY **GREENER OPTIONS**

9 WAYS TO REDUCE PLASTIC IN YOUR SCHOOL Organise school, park, Hold an adjucational ling plastic bottles ilm screening or tall river and beach d reusables instead



Rethink catering options to

liminate single-use plastic





Ditch the laminator, choo plastic-free displays





plastic-free



er schools too #LessPlastic

REDUCE, means to use less and NOT waste.

This is the second step. Reduce the use of harmful, wasteful, non-recyclable products. Reduction of and sinale-use products can result in less waste materials ending up in landfill. Use the minimum amount required.

Here are some examples of reducing materials:

- Ensure printed documents are double-sided.
- Buy sturdy cloth or recyclable bags that can be reused.
- Buy a larger container instead of two smaller ones.
- Buy products that do more than one thing-for example, 2 in 1 shampoo and conditioner.
- Buy concentrated products or compact packages, such as juices, fabric softeners, and cleaners you can mix with water at home.
- Look for products with minimal packaging- so that you will have less to throw away.





Reducing waste is the most important thing we can do. By reducing waste, we avoid the unnecessary use of resources such as materials, energy and water. It means there is less waste to manage.

How can we reduce waste?

- Buy in bulk to reduce packing.
- Take a reusable shopping bag with you so you don't have to use a paper or plastic bag from the shop.
- Say 'No' to a plastic shopping bag when you only have a couple of items.
- Choose products that use less packaging.
- Buy reusable items rather than disposable ones.
- Stick a "no junk mail" sign on your letter box.
- Take your lunch to school in a reusable container.

500 million tonnes of plastic are produced annually worldwide

In 2020 we will generate 900% more plastic than in 1980

By 2050 the oceans could contain more plastics than fish







Reduce the use of harmful, wasteful, and non-recyclable products. Reducing dependency on these kinds of products results in less waste materials ending up in landfill and the associated negative environmental impacts.

We recommend always using the minimum amount required to avoid unnecessary waste. For example, when printing a document, print double-sided to cut your waste output in half. Other commonly used items businesses can focus on reducing include single-use plastics, plastic packing, organic waste, and Styrofoam cups.









Single-use plastics have created a "throw-away" culture by normalizing consumer behavior of using materials once and then throwing them away. The rate at which we consume plastics has become unimaginable, and the plastic crisis has become one of the world's greatest environmental challenges.

In an effort to reduce waste, reuse items throughout the workplace instead of buying new ones. Begin by focusing on one area of your business at a time, like the break room. Replace all of the single-use eating utensils, Styrofoam cups, water bottles, and paper plates with compostable or reusable alternatives.

Once you master one area, prioritize reuse for other products in your facility like packaging peanuts, printer cartridges, cardboard boxes, food containers, and rechargeable batteries.







REUSE or REPURPOSE, means to reuse existing products or materials instead of throwing them away. This is the third step. In an effort to reduce waste, reuse items instead of buying new ones. For every item that can't be refused, reduced, try reusing or repurposing it. Repurposing is taking something previously created and transforming it, or a section of it, into something completely different.

Here are some examples of reusing or repurposing materials:

- Pass on magazines, catalogs, and books to neighbors, hospitals, libraries, schools or other local organisations.
- Use tin cans or tyres for potting new plants.
- Reuse plastic or glass containers for storage of food or other household items.
- Reuse glass jars as drinking glasses.
- Reuse shopping bags and sturdy cardboard boxes for storage.
- Reuse wrapping paper, newspapers, gift bags, and bows for future gifts.







That way it doesn't go in the rubbish and end up in the landfill. It also means you don't have to buy a new product. That saves you money and saves the energy and resources that would have been used to make the new product.

How can we reuse waste?

- Give unwanted toys and books to hospitals or schools.
- Put unwanted clothes in used clothing bins.
- Use plastic containers for freezing or storing food items.
- Save wrapping paper and boxes to use again.
- Use old jars for storage.
- Take old magazines to your local doctor's or dentist's surgery.
- Shop at second hand stores or use online trading websites to buy items that are unwanted by others.
- Take household items to your council's resource recovery centre.
- Make memo pads out of waste paper.
- Re-use envelopes purchase reuse labels.





Reuse' is simply about taking an old item and changing how you use the object. This can include fixing an item, refurbishing, redecorating, or editing an object in some way to make it better or give it a new purpose.

One of the most common ways people reuse things is by refurbishing them like electrical items or furniture, so it maintains its original purpose.

Meanwhile, upcycling is a form of reusing an item, but for a different purpose. For example, turning old unwanted items like old jeans and shirts into rags, or turn the old newspaper into a biodegradable flower pot!







Repurpose – to take something and use it for something else. This requires a bit of thinking and craftiness, but doesn't have to be beautiful.

Repurpose scrap paper for taking notes. Repurpose metal cans, buckets for creative plant containers.

Repurpose wood crates into benches or shelves. Repurpose material savings to help clean up spills.





RECYCLE



Once you've gone through all of the other R's, recycling is the most environmentally friendly waste disposal method. If your business doesn't already, start collecting cardboard, mixed paper products, commingled materials (plastics, aluminum, glass) and organics. Most companies we speak with are surprised by the amount of waste they reduce by establishing an effective recycling program.

<u>RECYCLE is simply "to use something again".</u>

Separating at home and work is one of the most significant steps to improving efficiencies at waste facilities and therefore reducing the cost of waste management.

Recycling is great in a lot of ways, the ultimate goal is to get people to prevent waste in the first place. Refuse, Reduce and Reuse before you Recycle.



RECYCLE



Recycling generally is a three-step-process (collecting & processing, manufacturing, and buying/ selling new products) that relies on several different parties to participate – from the public to the industry. And this process consumes energy.

A lot of it. And recycling still produces waste (unlike reusing) in the process from taking material and reprocessing it to create a different material or item.



RECYCLE



Here are some reasons why recycling should be upheld:

- Recycling saves landfill space.
- Separating your recyclables from your general waste improves efficiencies at waste facilities which in turns reduces the cost of waste management.
- Recycling benefits the environment and has a positive effect on the economy.
- Recycled products can be lucrative turn your rubbish into your next business venture.
- Recycling involves some form of reprocessing of waste materials to produce another product. For example, recycling plastic bottles to make buckets.

What can be recycled?

The main products that can be recycled are paper, cardboard, glass, aluminium, tin and plastic containers. Composting and worm farms are methods of recycling organic waste.





Don't sweat yourself about <u>biodegradable</u> waste such as food scraps. Let it rot. Make a compost system and always separate them from the other types of garbage.

You may also search for some nearby food scrap drop-off center (like a farmer's market or community garden) within your place. Best of all, you may start your garden and use your compost to supplement your plants.







ACTIVITY



REUSE & RECYCLE...



ACTIVITY



BASIS FOR COMPARISON	REUSE	RECYCLE
Meaning	Reuse, means putting an item to same or a different use, after it has fulfilled its original function.	Recycle is a process, wherein a used item is turned into a new product, to reduce waste of potentially useful material.
Form	Does not change the original form of the product.	A new product is created, so form of product is changed.
Harm to environment	It does not harm environment, in any way.	It sometimes causes harm to environment.
Energy	Saves energy	Consumes a little amount of energy, but saves it too.
Objective	To elongate the life of article.	To use basic material in the creation of various products.











SUSTAINABLE LIFESTYLE ACTIONS IN YOUR CITY OR COUNTRY.

Below you find five actions that you can take in your city or country.

- 1. Walk, cycle, and take public transport
 - Driving by car or plane can be very convenient. However, the burning of gasoline pollutes the air and emits CO2. Consider some of the following actions for a more sustainable lifestyle:
 - Walking or cycling improves your fitness and health. Sharing a ride or hitch-hiking allows you to connect with strangers. Taking the train or bus to get somewhere might take longer, but can be a great way to see the countryside, slow down, read a book, and connect with friends on the journey.
 - Take the train or overland busses instead of the plane,
 - Get a monthly public transport card,
 - Share a ride or hitchhike,
 - Get a second-hand bike,
 - Walk or run.





SUSTAINABLE LIFESTYLE ACTIONS IN YOUR CITY OR COUNTRY.

2. Bring your own bag, refillable bottle, and cup.

- Plastics are a marvelous invention of the industrial revolution. At the same time, they are a curse for the environment.
- Get a reusable coffee cup to avoid having to buy single-use cups,
- Bring your own bag to shops to reduce the usage of plastic bags,
- Try to avoid buying fruits or vegetables wrapped in plastics,
- And use a refillable water bottle to avoid having to buy plastic bottles.





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SUSTAINABLE LIFESTYLE ACTIONS IN YOUR CITY OR COUNTRY.

3. Share on social media

You're probably active on multiple social media channels and have a wide social network.

Share the posts of pages related to sustainability issues,

Or get active on social media groups related to sustainability.

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SUSTAINABLE LIFESTYLE ACTIONS IN YOUR CITY OR COUNTRY.

4. Find sustainable shops

- A first action you could take is to find sustainable shops in your city. Look out for:
 - Second hand-stores,
 - Vegetarian or vegan restaurants,
 - Plastic-free supermarkets,
 - Repair cafes,
 - Organic supermarkets,
 - And local farmers markets.
- Once you have found these shops, you could try to buy from them more regularly.





ACTIVITY

Examples of Students' Action Plans:

Students install photo sensors and motion sensors to turn off lights when natural light is adequate or when rooms are not in use.

They delamp (reduce the number of light bulbs) in areas where the quantity of light exceeds recommendations. The school purchases energysaving light bulbs, computers, and appliances with 'Energy Star' labels.





ACTIVITY

Energy is an important environmental issue, and the challenges bring together fields such as economics, environmental science, sociology, political science, and engineering. Students who are more informed about energy issues and the science behind them will be better equipped to come up with solutions to our energy problems.

Students investigate how much energy their school uses, the main sources of that energy, and ways to implement energy-saving strategies.

The Investigation details specific things for students to measure and observe, along with student worksheets to fill out and guidance on how to combine data collected into a school-wide analysis.

In the Energy Investigation, students determine the main sources of energy used to supply electricity to their school or community and investigate the renewable or nonrenewable sources.

Using the data collected from the Investigation, students can develop action projects to implement in their community that help save energy.



ASSESSMENT GUIDE

MINI PROJECTCASE STUDY

RECYCLED WASTE

Find your own product based on the recycling of waste.

From the product:

- Discuss the issues / problems and investigate the cause of the problems and describe about your project selection using the rubrics as references.
- Relate and elaborate the issues / problems with the current enforcement either from Environmental Quality Act (EQA 1974), Kualiti Alam or others (government enforcement) and write in the suitable topic at report.
- Report must be at least 15 pages, including reference.
- Format: Font Arial size 12. Paragraph 1.5 spacing. Left margin 2.54cm, right margin 2.54cm.



RECYCLED WASTE









RECYCLED OIL: MAKING BAR SOAP



RECYCLED OIL: MAKING BAR SOAP

PPE:

- Gloves
- Mask
- Goggle

SAFETY PRECAUTIONS:

- Ventilation.
- Safe environment.
- Standby vinegar.
- Separate equipment.
- Kids not allowed.

RECIPE:

<u>LYE & LIQUID:</u>	
• LYE	61 gm
(sodium hydroxide)	
 Liquid (water) 	136 gm
<u>OIL & FATS:</u>	
 Recycled Palm oil 	300 gm
Coconut Oil	100 gm
TOTAL:	<u> </u>



RECYCLED OIL: MAKING BAR SOAP

EQUIPMENT:

Stainless steel bowl.
 Jug.
 Spatula (silicone)
 Whisk
 Kitchen scale
 Molds



METHOD :

 Measure the ingredients.
 Make LYE solution (add LYE into water), then whisk until all LYE dissolves and clear.
 Mix LYE solution into oils.
 Whisk or hand blend until trace.
 Add fragrance / color (optional)
 Put into mold.
 Cut when cool.
 CURE for 1.5 – 2 months (complete saponification process)



RECYCLED OIL: MAKING BAR SOAP

NOTES :

- LYE or Sodium Hydroxide that used in this method are in form of flakes or granular. Both type of LYE can be used in this method.
- LYE also known as Caustic Soda. The chemistry short form for LYE is NaOH.
- LYE is one of the type alkaline salt, which have the corrosive character. SO, it is important to handle LYE.
- it is also have exothermic reaction when mixed with water. so, it is important to mixed it slowly and used glove, mask and goggle to avoid any injuries during the rraction.





RECYCLED OIL: MAKING BAR SOAP











TAKAKURA COMPOSTING



MINI PROJECT 3: TAKAKURA COMPOSTING

PRODUCTION OF COMPOST:

Effective production of microorganisms is produced by using ingredients such as vegetables, fruits, yogurt, yeast and brown sugar. The materials are soaked using chlorinefree water for two weeks. After that, the liquid is filtered and can be used.





TAKAKURA COMPOSTING

<u>COMPOST PREPARATION</u> <u>MATERIALS AND EQUIPMENT:</u>

Preparation of raw materials 1. Salt fermentation liquid: mix salt, mustard greens/kangkong/spinach, orange peel and apple into water.

2. Brown sugar fermentation liquid - Mix tempeh, taucu and brown sugar into the water. Both fermentation liquids are fermented for three to five days. After a week both liquid solutions are mixed into rice husk and black soil.





TAKAKURA COMPOSTING

Preparation of dry ingredients:

- 1. Basket
- 2. Jar
- 3. Black soil
- 4. Scoop
- 5. A large plastic box
- 6. Burnt rice husks



- After entering the second week, the leftover food will be mixed into rice husks and black soil.
- After a week mix the water in the first and second jar into the husk and black soil alternately. Leave for 7 days.
- After 14 days, feed (bread, leftovers) to rice husks. To grow fungus. There is an increase in husks and black soil.
- Make sure the leftovers are eaten well (decay) before adding other leftovers. After a month to two months, sprinkle fertilizer around the plant.



TAKAKURA COMPOSTING







- 1. In a group of maximum FOUR (4) members, write the complete report for a case study at the solid waste landfill site.
- 2. The submission date of case study report is on
- 3. The report content:
 - a.Introduction.
 - b.Content.
 - c.Company profile.
 - d.Background of site.
 - e.Current operation process.
 - f.Problems / issue. (ex: operational, management, budget, equipment, staffing and etc.)
- 4.Relate and elaborate the issues / problems with the current enforcement either from Environmental Quality Act (EQA 1974) or Environmental Department (Jabatan Alam Sekitar)
- 5. Results of Solid Waste Composition Study.
- 6.Discussion and Suggestion for future. (Ideas or opinion from company and your group members.)
- 7.Conclusion.
- 8.References.
- Format report; Font Arial, Size 12. Paragraph 1.5, Spacing. Left margin 2.54cm, right margin 2.54cm.

CASE STUDY 1:

Landfill Visit

1. EXAMPLE OF SOLID WASTE COMPOSITION DATA:



SOLID WASTE AND PUBLIC CLEANSING MANAGEMENT CORPORATION (SWCorp) MINISTRY OF URBAN WELLBEING, HOUSING AND LOCAL GOVERNMENT WISMA UGA PANTAI,TINGKAT MEZZANINE, 2, 3 DAN 4, NO. 11, JALAN JAYA (JALAN 4/83A) P.O. BOX 12038, 52300 KUALA LUMPUR.



		SAMPLING/SO	RTING DATA	SHEET				
Day/Date/Time of Sampling				30th JI	JLY 2019			
Sample No.								
Source of Sam	ple		TAPAK P	ELUPUSAN	PADANG CINA, KU	LIM		
General Rema	nk		4	2	2	Autoropo		
		Mainht (kn) - waete +			3	Average		
		Weight (kg) - Waster+	12	12	12	12		
	F	Weight (kg) - waste	19.8	22.8	20.8	21.1		
		Volume (m3)	0.05	0.05	0.05	0.05		
		Density (kg/m3)	396.0	456.0	416.0	422.7		
Waste Components	Detail of Wast Components	te 1	2	3	Total Weight (kg)	Percentage by weight (%)	Total percentage by weight (%)	
Food Waste	Avoidable	9.2			9.2	3.9	22.9	
Food Waste	Non-avoidable	24.0	20.4	26.4	70.8	29.9	55.0	
	Newspapers and Mag	gazines 1.6	2.0		3.6	1.5		
Danare	Other Recyclable pag	per 10.4			10.4	4.4		
Papers	Card and packaging	4.2			4.2	1.8	5.1	
	Non-recyclable paper	r 1.0			1.0	0.4		
Tetrapek		0.6			0.6	0.3	0.3	
Plastics	Plastic (Rigid)	4.4	5.3		9.7	4.1	21.2	
	Plastic (Film)	12.4	15.0	10.8	38.2	16.1		
	Plastic (Foam)	2.4			2.4	1.0		
Diapers/hapkins		24.8			24.8	10.5	10.5	
Textile		13.4	3.1		16.5	7.0	7.0	
Rubber/Leather		2.1			2.1	0.9	0.9	
Wood		0.2			0.2	0.1	0.1	
Garden/Yard		1.0	17.0		18.0	7.6	7.6	
Glass		2.8			2.8	1.2	1.2	
Metal	Ferrous	0.6			0.6	0.3	0.8	
	Non-Forous	1.4			1.4	0.6		
Household Hazardous Waste	e-Waste	0.2			0.2	0.1	0.5	
	Hazardous waste	1.0			1.0	0.4	0.0	
Co mingle		17.8			17.8	7.5	7.5	
Others		1.0	0.6		1.6	0.7	0.7	
		100		Total	237.1	100.0	100.0	



1. EXAMPLE OF SOLID WASTE COMPOSITION DATA CHART:



CASE STUDY 2: <u>MRF Visit</u>

- 1. In group of FOUR (4) members, write the complete report for a complete case study at the Material Recovery Facility (MRF) Station, Green Resource Recovery Sdn, Bhd.
- 2. The submission date of case study report is on
- 3. The report content:
 - a. Introduction.
 - b.Company profile.
 - c. Background of site.
 - d. Current operation process.
 - e. Problems / issue. (example: operational, management, budget, equipment, staffing and etc.)
 - f.Relate and elaborate the issues / problems with the current enforcement either from Environmental Quality Act (EQA 1974) or Environmental Department (Jabatan Alam Sekitar)
 - g. Solutions.
 - h.Suggestion for future. (Ideas from company and your group members.)
- 4. Format report; Font Arial size 12. Paragraph 1.5 spacing. Left margin 2.54cm, right margin 2.54cm.



EXAMPLE: VISITING MATERIAL RECOVERY FACITILIES (MRF) STATION AT ALOR SETAR, KEDAH.









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