Municipal Solid Waste Management
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Lecture No - 16
Unit operation for component separation

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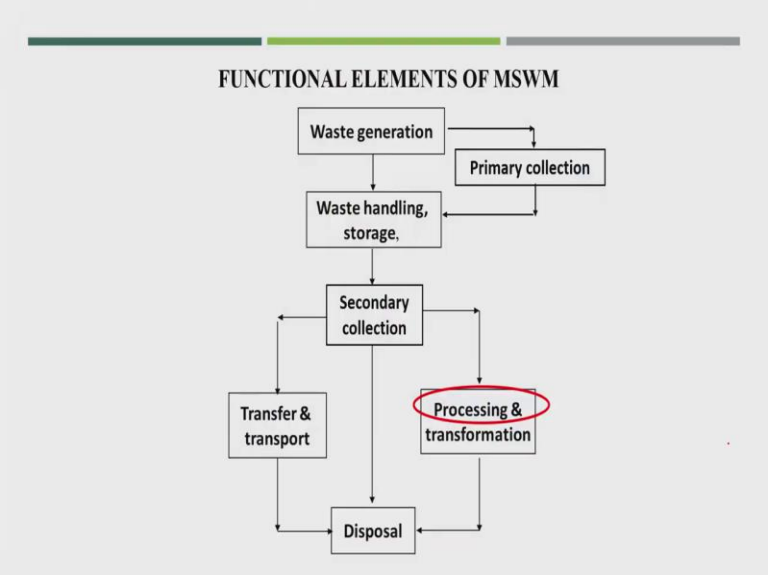

Hello students, today we will start the new module, separation and processing of solid waste. So we are now on the 5th function element out of total 6 function elements. So here in this module, we will be talking about processing. So I will take to classes on to the processing and this processing mostly focused on to the recycling. Because I think we have already discussed in the previous lecture, that we already collected the waste in the two parts.

One is the wet waste and other is the dry waste. So first I think we will talk about dry waste but the dry waste is further in the mix way. We did not segregate again component wise. I propose that if in the small quantity is there could be possible at community level otherwise it has to go to the now centralized recycling facility or processing facility. So once we finish the recycling one because the similar dry waste also will be utilized for the treatment process also in this specially the chemical treatment process.

Where we will talk about combustion and incineration about that particular dry waste ok and followed by transportation, we will also talk about the treatment of wet waste composting vermicomposting are on the medicine methods will discuss into that. So first we will focus on to the processing. So this lecture is majorly onto the unit operation for component separation.

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So see that in the previous lectures many times, I talked about managing the waste at home to say no to the single bin and in the Swachh Bharat mission also dry waste and wet waste as to get segregated at the household level. So, these are the two and also a special focus was given to the Swachh Bharat mission also because segregation was found to be a very important and without that a very difficult to treat.

So mixed waste cannot be treated ok and this is the best segregated biological dry and wet waste and biological waste will go to the biological treatment process like composting or anaerobic digestion process and dry waste or non biodegradable waste will go for further treatment may be for the recycling process or combustion process or chemical treatment process.

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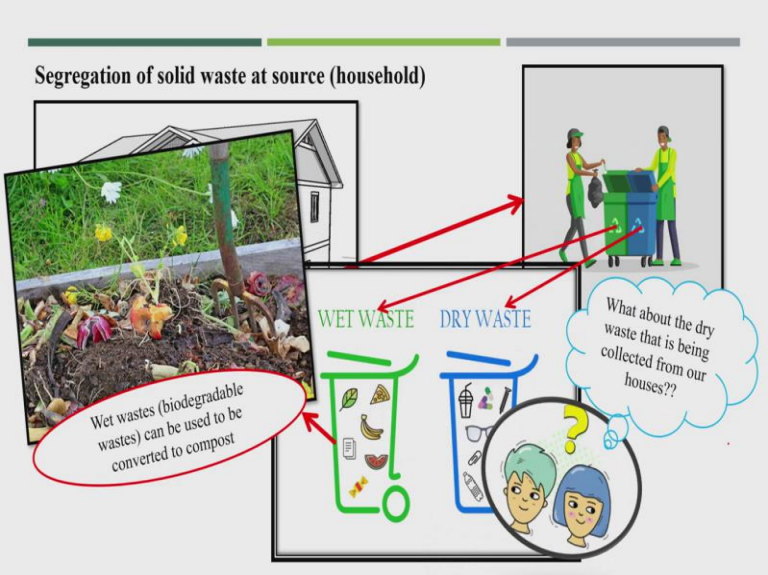

So as I proposed in the previous class also asked to segregate the waste at the household level in the wet waste and dry waste ok and the wet waste will be used further in the composting process. And now the dry waste because the entire wet waste will go for the treatment process, there is no need of any segregation from the wet waste, whether it is a cooked waste or uncooked waste that all kind of that waste could be possibly used for biological treatment process. But problem with the dry waste now is that dry waste is a mix of different-different components.

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Like you recall that in one of the lecture I talked about the dry waste could be a cardboard paper board glass plastic different kind of plastic. Ok which I think in the next class I will be talking about different kind of plastics and their recycling process also, the paper and other different

kind of dry waste. So now has to be this problem is that suppose this all the components are together we cannot go for the recycling process because for every recycling process again the segregation.

I think we can see the re-segregation is required because when you go for glass so the different recycling process, when we go for metal different recycling process, like paper, plastic different recycling process is available. Mixed waste cannot be possible to get recycled.

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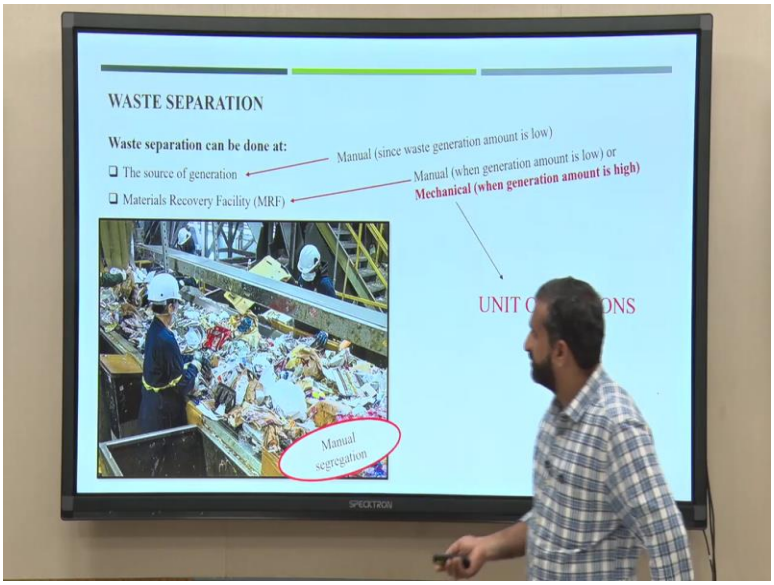

So like waste separation I had the talked about source of segregation source of generation at household level of community level. If the quantity is less, then it can be possible. So with the objective of waste separation as in the previous class also I told to modify the physical characteristics remove specific component and also prepared to subsequent uses for that purpose you need segregation or separation or even separation from the dry waste itself.

Ok, so it sources of generation manually we will do the segregation because the quantity is very low suppose in the household level, suppose local authority will ask to segregate plastic from the dry waste so manually it will be get separated from that and suppose the local authorities have proposed to segregate glass and metal which is which cannot be go for conversion process also these both components will get segregated household level.

If suppose household level is not possible so we can go to the community level may be in the one particular apartment the segregation facility could be possible maybe it is not only one apartment but maybe 3, 4 nearby apartment also segregation facility could be possible. But the segregation will be manual we do not require the mechanical facility for that. But once I think this waste this entire mixed dry waste will come to the MRF or Material Recovery Facility or Recycling Facility.

then it will be requiring mechanical, so manual can be possible is again the quantity is less similarly showing that here if the quantity is low then it can be possible manually by putting number of man power would be possible and again is depend upon the objective, suppose here the objective is to only at MRF station. The objective is only to segregate the plastic, so it is possible or paper wise segregation or like metal and glass so, based on that manually it can be possible. But if you are saying that entire this 10 to 12 or 15 kind of component need to be segregated manual is very difficult if the quantity is large.

So if the quantity is large to we should go for mechanical when generation is high. So for that we will require different kind of unit operation and unit operation so the idea of this unit operation not only the segregation of components from the mixed dry waste, but also required to prepare the same material for the subsequent uses and also require proper transportation of that particular material could be possible that in the MRF locality only the unit operations will be available and after that the entire waste will go to the another location.

Specific component will go to the another recycling facility. So for transportation also that particular material will be required and for storage facility also you need further treatment of that particular component. So which; we are going to talk about different unit operation in this class.

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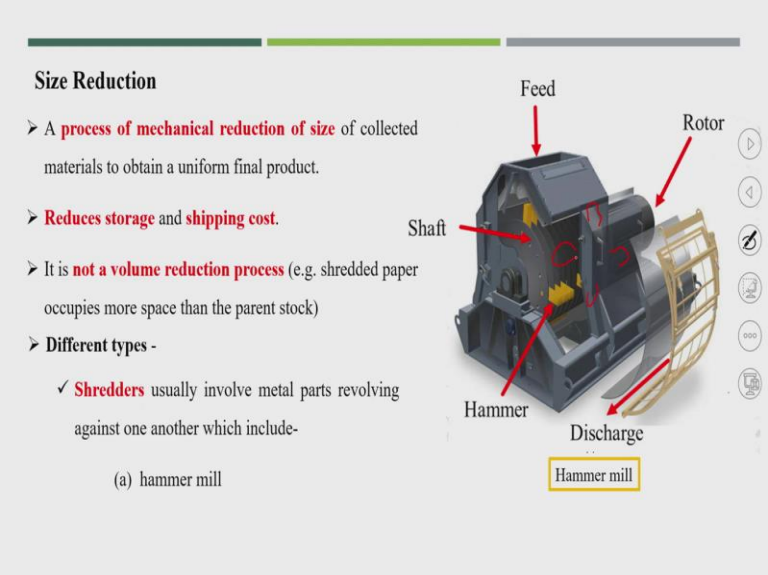

There are five different kind of unit operation normally required for segregation at MRF station in the mechanical way. So first is the size reduction. This is one of the very important unit operations. This process of mechanical reduction of size of collected metal to obtain the uniform final product and why we need the uniform final product, to reduce the storage and shipping cost because for shipping also if the uniform product will be there so the storage and shipping cost can possibly be reduced.

So, but need to understand that it is not the volume reduction process see size reduction just see that size reduction is not volume reduction by one example I gave here the shredded paper occupy more space than the current stock. See once you shred or once you reduce the size of paper it will be requiring more volume rather than the parent or the normal paper ok. There are different kinds of methods used for the size reduction.

first is the shredders usually involved metal part really against one another which includes forces the hammer mill. So this is one of the diagram of the hammer mill. So these are the hammers. which will shred the materials and, this the actual photograph. So you see here these are the hammer that is getting shred.

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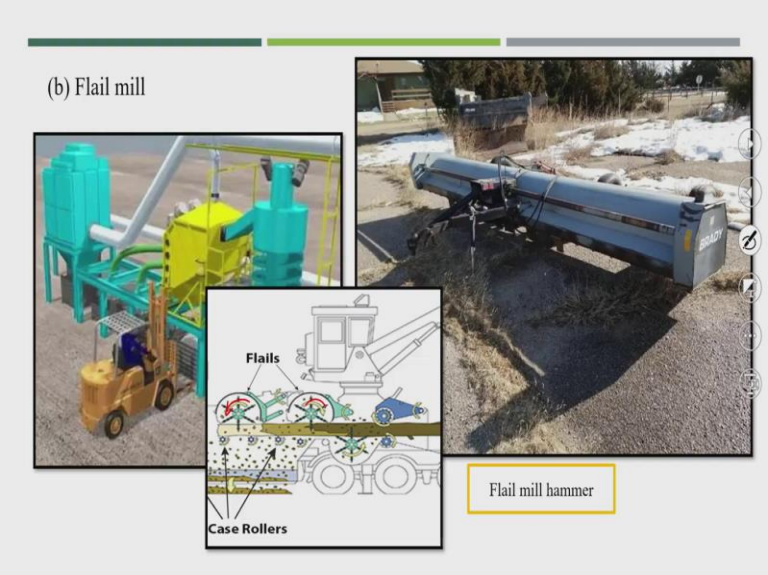

This is another equipment or method that is treadmill hammer. So from that also is possible to get shred the material. These are the flail mill, and different kind of shredding facility near.

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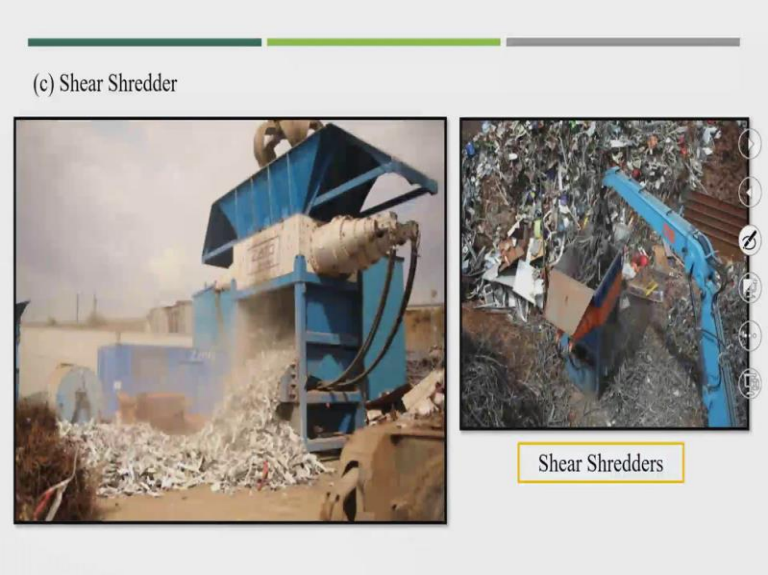

Now shear shredder, these is another type of shredding by the shearing of the material. So here the waste is loaded from the top and this is the shredded material.

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So some other type of size reduction operations this is one glass crusher this is a well known you can find a lot of in YouTube also on this kind of shedder. The very hard crushes or shedder this is another one. This is a glass cutter. One of the country is in Australia is a mobile glass crusher. So these crushers can be you can take it to any other locations easily is called as a mobile glass crusher.

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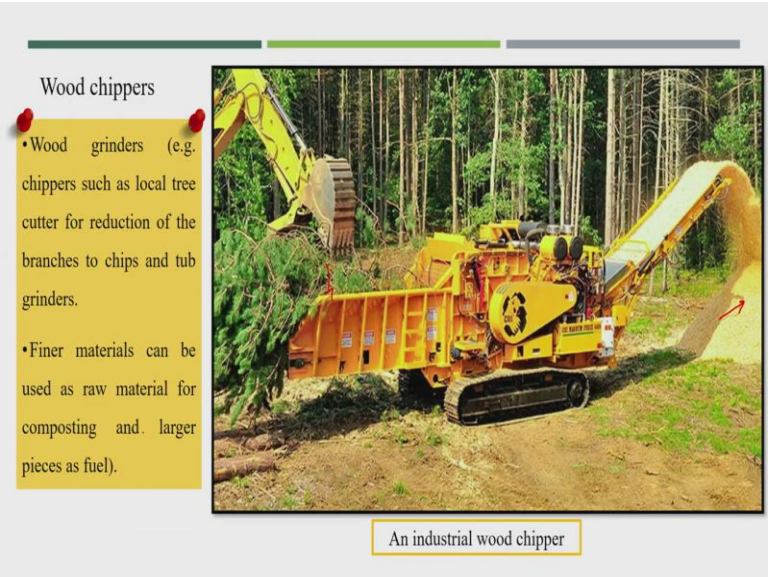

and this special one wood chipper industrial wood chipper to directly woods is getting shred into the small size. So where wood grinder chipper such as local tree cutter for the reduction of the branches to chips and top grinder. Fine material can be used for raw material for composting,

composting required for to maintain the moisture content requires the dry matter. A larger piece here.

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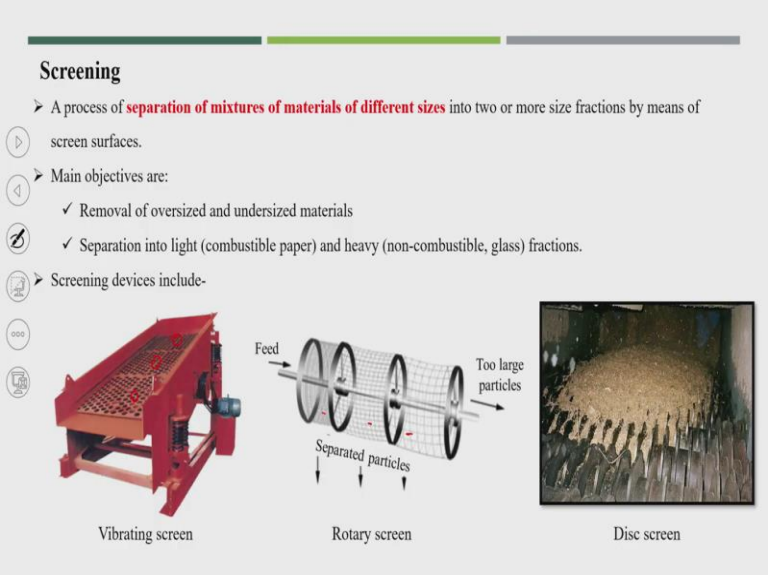

Now next unit operation is the screen or screening: This process of screening is a separation of mixture of the material of different sizes into two or more size fraction by means of screen surfaces, so the; what is objective of the screen to remove the oversize material. Ok so that the final product will get the uniform and separation into light or heavy fraction. So, in the entire dry waste is mixed dry waste, what could be the light material like paper, plastic, rubber, cloth could be a very light material.

and heavy metals, like leather, glass, metal will be the heavy material and separation is required for the both the material, and specially if unable to segregate glass and metal from the and other material dry material is required why because they both are not the combustible material. So if you are planning for this waste will require as a fuel so this because of that we need to segregate glass and metal from the mixed dry waste.

So there are different kinds of screening devices. This is the vibrating screen. So you can see here there are different, different sizes so that different fractions or different size fractions. We can get it from the screen. This is another rotary screen here also you can see the different sizes this is smaller one somewhat bigger and bigger one, so large particle we can get it. This the disc

screens. So by using different kind of screen we can screen the entire material by different kind of size material we can separate here.

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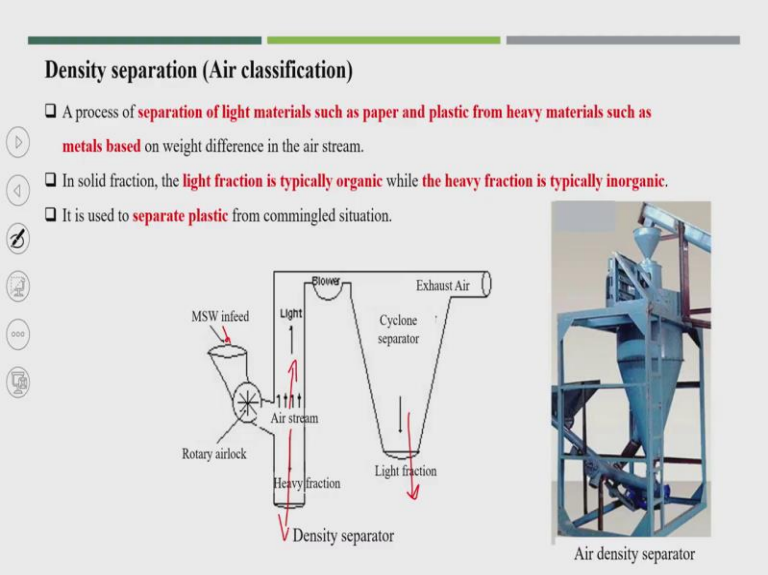

Next is the density separation. This method is specially used for the separation from the light material to the too heavy material. A process of separation of light material; such as paper and plastic from heavy material such as metal based on weight difference in the air streams. So in the solid fraction the light fractions are typically organic and while the heavy fractions typically inorganic. Suppose the entire biological waste also will come into this kind of mix or this kind of unit operation.

This also will become that will be a light material can also get separated from that. It is used to separate specially the plastic from the commingled situation mixed material. So this is the one-line diagram you can see that, so here MSW is getting fed here and here the air stream in the upper way, so light material will come out from this fraction and heavy metal will be in the bottom fraction and both materials will get separated. So this is one photograph also you can see that it is getting feed.

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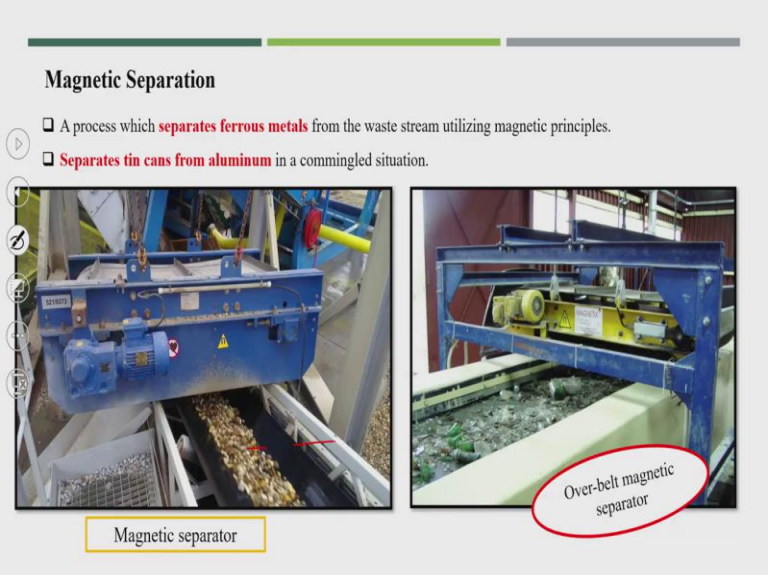

Magnetic separation this method is specially used to separate the ferrous metals from the waste stream utilizing magnetic principle, so it can separate the tin cans from the aluminum in the coming and situation. So this is one of the line diagram you can see that. By having the magnet, the nonferrous metal and ferrous metal will be separated this is one of the photograph you can see here. Magnetic separator this is the over bed magnetic separator where glass is getting separated.

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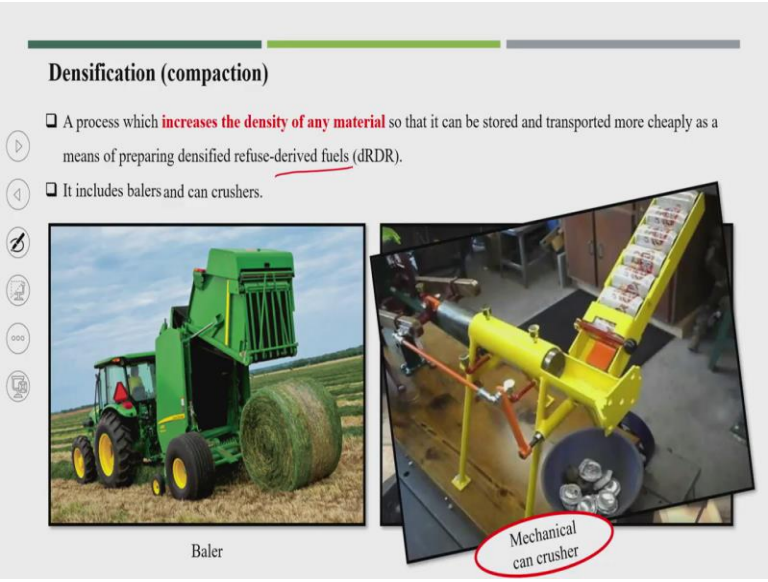

Next is the densification or compaction. This will be our last process of the unit operation. A process which increases the density of any material so that it can be stored and transported more cheaply as means of preparing densified refused derived fuel. The refused derived fuel will have

discussion on the next lecture. We called is RDF or facility because once you go for agent fuel process also.

Now waste should be a compacted one so that the transportation also will be easy storage also will be easy. It includes the by using the different balers, like this one is one of the compactor. This is the glass crusher from that also we can get proper compaction of the entire material. This is another mechanical crusher.

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Now under this unit operations will be required different facilities for waste handling moving and storage of mixed dry waste. So will be required different kind of conveyor belts this conveyor belt handles for transport the waste from one location to another location inside the unit operation facilities, this is very important because manually segregation also transportation also is very difficult.

These all unit operations will be together. So the transportation of the waste from the one unit to the another unit with the help of conveyor belts is more beneficial. This is the belt conveyor used in the recycling centre.

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So next is a movable equipments like front end loader and forklifts this kind of equipments will be always required. This is a Forklift ok, this is specially required for the storage of the material.

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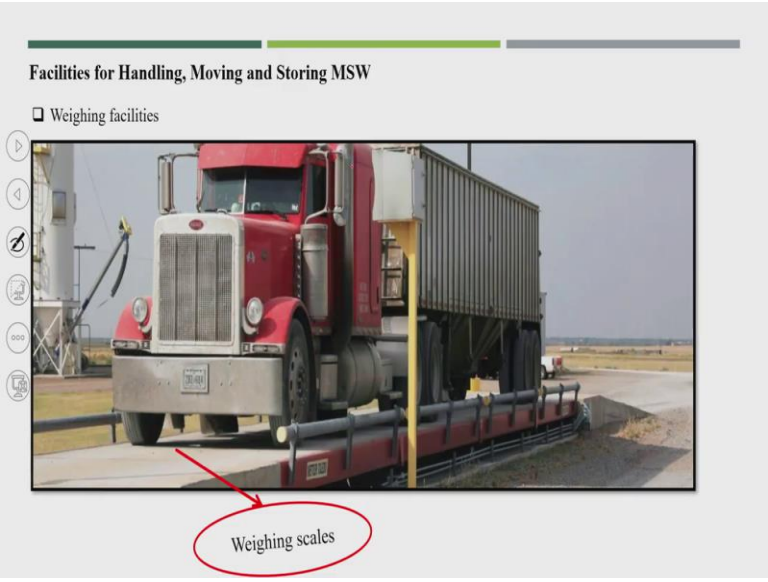

Next is the weighing facility, so obviously in the unit operation weighing facility should be required because when the waste is entering to the facility and when the treated material will go out from the facilities need to be weighed properly.

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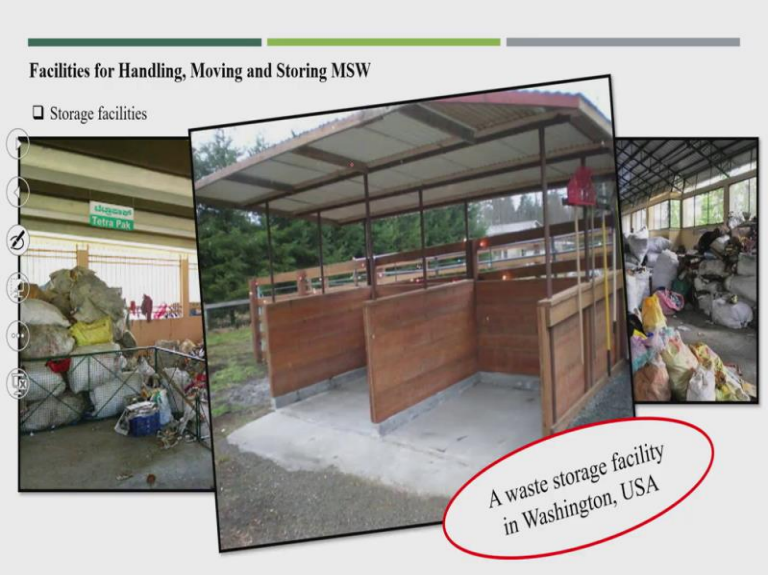

Next is the storage facility. So you will be require a proper storage of the waste, whether it is a treated or untreated proper storage facility is required of mixed dry waste you can see it is one of the facility in USA Washington storage facility of dry matter. So once the all components will be get segregated need to be a properly stored.

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So, here I am showing one small video 5-minute video and by that we can see that how this unit for operation will work together. So this video is from Poland and it is also available in YouTube you can see.

Video Start Time: 21:29

So this is in Europe Warsaw here MSW from Warsaw city is coming is a mixed dry waste. You are seeing here there is no biological material. First it is going to the waste reception area. This kind of equipment's are required, so these are the shredder manual sorting of glass. So size wise these unit operations are working, the first is more than 300 mm size, and this could be possible manual picking up large material 10 to 80 mm size to different size 20 to 60 mm and more than 20 mm.

So these are the different sizes you can see here. This is the mixed plastic and is recovered, you can see with air the light material will get separated via the air separation method. So here from plastic itself the different fractions are getting separated and sorted to quality control. You see here manually it is again getting sorted out the required material in most of the European countries, the major fraction in the dry matter is the plastic, different type of plastic.

So their major focus on to the unit operations how best they can separate different type of plastics sorting of data packs this is another plastic separator optical separator. Every time you see that manual separation in the last process is the manual separation again was machine is not possible to remove the unnecessary materials into that. paper cutting yah manually checking now use final fractions 16 material fraction for the recycling.

RDF sorting this is specially RDF sorting already high quality RDF low content of PVC because PVC we cannot combust we cannot use an RDF and it is final shredded material is getting transported to the recycling facilities. So because of that reduction of waste landfill is reduced to 60% with their major concentrations are the dry wastes only.

Video End Time: 27:44

So by that we can understand the mechanical process is somewhat costly still India few cities this kind of units are available but not all the units are together. But it is again based on the objective like specially if you target plastic, this kind of mechanical separation is very beneficial. So once now segregation over, now we will be requiring the entire waste to go to the MRF station a material recovery facility.

It is also possible if MRF station material recovery facility is this unit operations are available in the same area. So in the next lecture I will talk about design of MRF, MRF material recovery facility and also the location wise also one very important issue need to be discussed. And now I will just talk about few recycling process, especially plastic how best we can recycle that and also what are the different material could possible to get recycled.

And what exactly the methodology is adopted for the recycling process that will discuss in the next lecture. Thank you.