

# INDUSTRIES ACTIVITIES

## Tales Tails Tell

All the materials that are used in daily life are derived from the earth's natural resources. Paper and wood come from trees, cotton comes from cotton plants, grains too come from plants; aluminium, steel, iron and tin are made from metallic compounds dug out of the earth; glass is made from sand, soda and lime, etc. Extracting and processing these has an environmental cost.

In addition, every product impacts the environment throughout its life—during its manufacture, use and after its disposal. Some products have a much larger impact than other products.

Decisions of individuals can influence what products are made. If people choose to reject a product that harms the environment in its manufacture, use or disposal, there will be a decrease in the demand for that product. Industry will not continue manufacturing a product which does not have a good demand.

### Objective

To help students understand linkages between items used in day-to-day life and natural resources.

### Activity

Divide the students into groups of 5–7. Give one item to each group. For example, one group will be given *neem* twig. The second group will be given tooth brush. Third group will be given the plastic container and fourth group will be given the earthen container and so on, depending upon the number of groups.

Assign each group a large area in the room. If you would like the groups to use the floor as the writing surface, give each of them chalks of different colours. If the floor cannot be used for writing, then give each group about 50 cards/paper pieces, and pens/pencils to write with.

Ask the groups to keep their items on the floor, with a distance of about one meter separating each.

### Subject

Social Science

### Place

Classroom

### Duration

30 minutes

### Group size

Less than or about 50

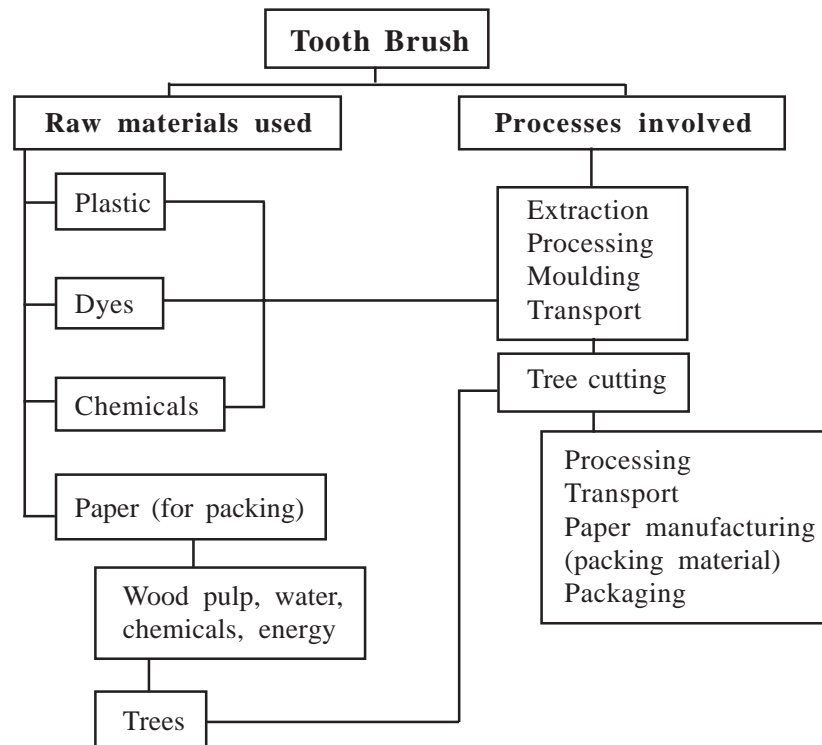
### Materials

Plain cards or pieces of paper (the size of visiting cards), stapler with pins or reel of thread (one for each group), pens/pencils. OR large floor space, chalks of different colours, Assorted items used in everyday life. For example, a packet of red chilli powder and red chillies, a steel glass and an earthen glass/mug, a tooth brush and a *neem* twig (the items should be combination of products i.e. one of the items should be processed product and the other, a commonly found ecofriendly alternative).

The task for each group is to trace back how that product is made, what raw materials are used and what are the processes involved in making it. For this, each group could make a link 'chain' or 'tail' with the help of cards/paper pieces or with the chalk on the floor. This chain/tail should show all the resources that were used in the manufacturing of the product and also the processes involved.

Each resource and process involved has to be written on a separate card. The cards could be linked to each other and/or to the item. They can be linked with pins or with thread. If the exercise is done on the floor, the name of each of the resources can be written on the floor with chalk and linked with lines drawn with a different coloured chalk.

For example, the 'Tooth Brush', tail would include the following (See the figure).



After 20 minutes, ask each group to take turns and present their findings to the other groups. The groups should highlight:

What does the chain/tail indicate?

What are the raw materials involved in making the product?

What natural resources are used in the process of manufacturing it?

Is the chain/tail a single tail or are there any interlinkages. If yes, what are they?

What are the environmental impacts of the processes involved?

The other groups can add new ideas and insights to the findings.

### **Extension/Variation**

The students can be asked to include the resources used during the use of an item (for example, the use of a toothbrush will require tooth paste, water, etc.), and its impact when it is discarded after its use (a plastic tooth brush will be in a garbage dump for years).

The students could also list down or make another 'Tail' of outputs (which are undesired but do occur) of various processes involved in making of one product, like by-products in chemical industry, smoke, etc.

**Subject**

Social Science

**Place**

Classroom

**Duration**

45 minutes

**Group size**

4 groups of 5–7 students

**Materials**

Copies of the map of Surajnagar, copies of the note on Surajnagar.

Laws, regulations and economic incentives have a significant role to play in environmental conservation. A government's role in environmental management includes developing policies for the management of public resources, as also making and enforcing laws and regulations for the protection of the environment. Environmental legislation must be dynamic in order to effectively protect the environment and prevent or rectify environmental abuses. In many cases, it becomes necessary to change the law or to make new laws and regulations as new information comes to light, or as technologies change. Laws which affect the environment should be made after considering all the possible consequences of each alternative. The ability of the legal system to uphold and enforce environmental laws and regulations depends heavily on public support, and on whether the prevailing laws and regulations are practical and enforceable.

**Objective**

To help students understand that laws and regulations have to be made considering the existing situation from all angles—environmental, social, economic etc.

**Activity**

Preparation: For the activity you will need:

Copies of the map of Surajnagar (one for each of the 5-7 groups) or a large drawing of the map displayed for all the groups to see; copies of the note on Surajnagar (one for each of the 5-7 groups).

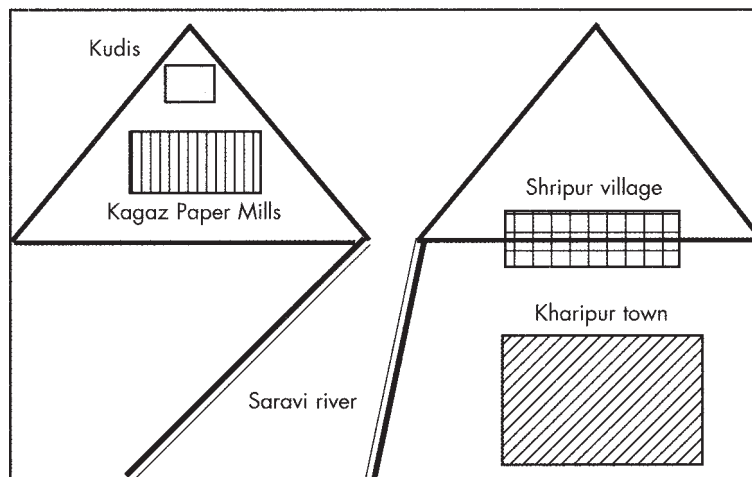
**Note on Surajnagar**

*Surajnagar has two big hills which are forested. A small tribal community called 'Kudis' lives on the top of one hills. The Kudis collect firewood and fodder for their cattle from the forest. They also collect medicinal plants and other forest products and sell them in the nearby village and town. The Kudis believe they are the original inhabitants of the area which is now called Surajnagar. Before the industry, the village and the town came up, their ancestors had the forests all to themselves. Now, because of pressure from the industry, from the village and the town, the forest resources are gradually declining and the Kudis fear that their future is under threat.*

*Shripur village is situated at the foot of the other hill. It has about 50 households. Most of the people here are farmers. They depend upon the forest for firewood and for wood to make their agricultural implements. They also send their cattle into the forest for grazing. They use the water of the Saravi river for irrigation, and are increasingly concerned that pollution of the river water by Kagaz Paper Mills is damaging their crops and harming the health of their livestock.*

*The industry located half way up on one of the hills is 'Kagaz Paper Mills (KPM)'. KPM gets its raw material, which is wood, from the forest. It also uses water from the Saravi river for paper production. Waste water and solid waste materials are dumped into and on the banks of the Saravi river. Most of the paper is marketed in the Kharipur town where there is a big demand for paper for books, magazines, packaging materials, etc. The industry is concerned about increasing protests from the tribals about the use of the forest timber and about complaints from the villagers about pollution. The large settlement you see is the Kharipur town. It is a growing town. It uses the forest wood for construction. The garbage and sewage from the town is let into the 'Saravi' river.*

### **Surajnagar Map**



Divide the class into four groups of about 5-7 each. Give one copy of the Surajnagar map to each group or display a larger version of the map so that all the groups can have a good view of the map from where they are sitting. Ask the students to take a good look at the map.

Tell each group of students that each of their groups represents one group of people in Surajnagar. Give each of the groups their names: the Kudis, the villagers of Shripur, the Kagaz Paper Mill owners, and the Kharipur citizens.

Each one of the groups has been given the task of making laws, regulations, economic and social incentives for themselves and for one other group, to enable effective management of Surajnagar's natural resources.

The Kudis have to make laws, regulations and incentives for themselves and for the villagers of Shripur.

The villagers of Shripur have to make laws, regulations and incentives for themselves and for the Kharipur citizens.

The Kharipur citizens have to make laws, regulations and incentives for themselves and for the Kudis.

The groups have thirty minutes to complete the task.

After thirty minutes, ask each group to present the list of laws, regulations and economic incentives they have devised for themselves. Compare these to the laws, regulations and economic incentives devised for the same group by another group. For example, ask the Kudis group to read out the laws, regulations and economic incentives devised for themselves. Compare this to the laws, regulations and economic incentives devised by the Kharipur citizens group for the Kudis by asking the Kharipur citizens group to read out their list. Ask the participants to note the following:

1. What laws, regulations and economic incentives do they think will work and why?
2. Was there a balance in the numbers of laws, regulations, and economic incentives devised? That is, for example, were there more laws as compared to incentives? Why was this so?
3. What is the difference in the two sets of laws, regulations and economic incentives devised for a particular group? For example what was the difference in the laws, regulations and economic incentives devised for the Kudis by the Kudis themselves and by the Kharipur citizens?

## **Discussion**

What is the role of legislation in ensuring better natural resource management?

Making and enforcing laws and regulations for the protection of the environment is part of the government's role in environmental management. Dynamic environmental legislation, if effectively enforced, can protect the environment and prevent and rectify environmental abuses.

Can economic incentives be effective in ensuring better natural resource management?

Economic incentives can play a role in motivating people to adopt actions that contribute to environmental conservation. For example, the Government of India offers several incentives to motivate industries to comply with the various environmental standards prescribed under different Acts and Rules to control and prevent pollution. Some of these are:

- Loans at reduced rates of interest for installing pollution control devices.
- Financial assistance to small-scale industries for setting up common effluent treatment facilities.
- Excise duty exemption for bricks and blocks made from flyash and phosphogypsum.

What are the factors that need to be considered while making laws and regulations?

Laws and regulations have to be made considering the existing situation from all angles—environmental, social, economic, etc. For example, supposing there is a restriction on collection of fuelwood and fodder from the forest, what alternatives do the Kudis and the villagers have? Another equally important factor is implementation. Laws that are made have to be implementable, and need to be implemented effectively.

In addition to laws, regulations and economic incentives, what other efforts are required for environmental conservation?

Laws, regulations and economic incentives have a significant role to play in environmental conservation. But by themselves they may not be adequate. For example, a more efficient technology may be required. If the KPM is provided paper making technology that uses less water and wood, and creates less waste, it can be less polluting and be more environmentally friendly. Similarly education and awareness are also required. For example, if the farmers of Shripur are educated about the optimum amount of fertilizer that is to be applied, the pollution of the Saravi river from excess fertilizer can be contained.

**Subject**

Language, Social Science

**Place**

Classroom

**Duration**

45 minutes

**Group size**

About 30

**Materials**

Writing materials

Industrial projects, be they large or small, impact the environment and the socio-economic conditions of the people. For example, an industry may provide livelihoods and contribute to foreign exchange. But it may pollute the environment and thereby impact peoples' health. Similarly, forest areas may be leased out for logging to promote exports of timber and timber products. But logging results in loss of forests and their biodiversity. Thus, any developmental project brings to the forefront environment and development conflicts. Understanding such issues requires analytical skills and a holistic view.

**Objective**

To help students understand the links of industries, development and environment.

**Activity**

Quoted below is a write-up from a website. Write this on the blackboard or on a chart paper, or give a photocopy to each student. Tell the students that they are going to learn techniques of comprehending information in a given text by doing a few exercises. Ask the students to read the paragraph carefully and answer the questions that follow.

*Stretching 400 kilometers from the busy city of Ahmedabad to Vapi, in western India, a series of sprawling industrial estates make up the "Golden Corridor". For industrialists the Golden Corridor is a heaven where all rules have been given the go-by by the government.*

*Hundreds of small and medium factories manufacturing chemicals, dyes, paints, fertilizer, plastics, pulp and paper, spew untreated wastes into the air and water, poisoning farmland for miles all around. Industrial gases hang in the air, especially in the winter, making breathing difficult. Most of these industries have no safe disposal system for toxic wastes and discharge it into the river. Thus, causes grave damage to the riverine ecology.*

*In Nandesari Village, 220 hectares of fertile agricultural land has been turned into a chemical industrial estate. Abundant harvests of cotton, sugarcane, peanuts and wheat grown in these region are being poisoned by factory wastes.*

Once-clear streams like the Amlakhadi are now **noxious**, and foul-smelling channels of black sludge have killed **livestock** that drank from it. In the Golden Corridor multi-coloured **hazardous** waste lies in heaps on which children play. Discarded chemical drums are also part of their playground.

Majority of the workers are poor migrants who are afraid they will lose their jobs if they raise issues of **occupational health** and safety. They complain of pollution, health problems, threat of accidents when containers explode, pipes burst.

As if this was not enough, in Gujarat's 1,600 km Arabian Sea coastline has been targeted for port-based industries. There is a lobby seeking denotification of the Marine National Park and its fragile mangroves, through which a proposed pipeline will carry crude oil from Oman to central and north India. A major portion of all future oil imports will arrive through Gujarat's ports. Already oil spills have affected vast stretches of mangrove forests in the Gulf of Kachchh.

The dream is to make Gujarat, the second-most urbanized Indian state, into a destination for business, ignoring its impact on people and the environment.

A Gujarat High Court order on October 21, 2002 prohibited the dumping of effluents into the Amlakhadi unless they are treated. But the National Environmental Engineering Research Institute (NEERI) has recommended that effluents be disposed in the deep sea. A 55-kilometer pipeline is under construction at a cost of \$3 million, although the National Institute of Oceanography is yet to complete its assessment of the impact on marine life. Regulatory boards which are the watchdogs on industry appear to be working at cross-purposes in Gujarat and there seems to be a lack of coordination between them.

Answer the following questions after reading the passage.

1. Do you think this is a fair and unbiased report?
2. Who are the people you would interview if you had to prepare such a report?
3. What will happen if these industries are closed off? List down issues that could come up.
4. Explain the following terms or words and use them in sentences.  
a) Noxious b) livestock c) hazardous d) occupational health
5. Find out more about organizations/institutions like *National Environmental Engineering Research Institute (NEERI)*, *National Institute of Oceanography (NIO)*, *Central Pollution Control Board*, etc.
6. Give an appropriate title to the passage.



**Protected Area:** A protected area is an area of land or sea specially set aside by the Government to protect and maintain the habitat and its wildlife. There are different kinds of protected areas.

**National Parks:** An area in which no one is permitted to destroy or remove any wildlife or harm its environment. People cannot own land in this area, nor can they let their animals graze there.

**Wildlife Sanctuary:** An area in which some amount of human activity may be permitted.

## Activity

## Whose Industry is Green?

### Subject

Social Science

### Place

Indoor

### Duration

45 minutes

### Group size

Minimum 2 players (at the most 4 at a time)

### Materials

Board game (could be drawn on floor), dice, Instruction cards (with movement instructions)

### Card Sheet

**2** You help in conserving natural resources. **Move 3 house ahead and gain 6 points.**

**4** Crushing and burning (heating) processes release suspended particulate matter into the air. This could cause respiratory problems to the community living nearby. **Move 4 houses back and lose 5 points.**

**7** You treat the effluents before discharging them into nearby river. **Move 6 houses ahead and get 8 points.**

**9** Vegetable dyes are less harmful to environment than chemical dyes used in most textile industries. **Move 4 houses ahead and gain 4 points.**

**11** Open cast mining causes air, water and soil pollution in the surrounding area. **Move 8 houses back and lose 7 points.**

*Continued on page 171*

Traditionally, the approach to controlling industrial pollution was to keep producing as always, but before throwing out the wastes from the industries, to try to clean them up. If there were undesirable chemicals/materials in the gaseous or liquid wastes, the effort was to try to remove them. Or if there were solids wastes, the effort was to try to dispose them where they would not be seen. This was done through a variety of pollution control devices.

Now however, the approach to pollution control is changing. The effort now is to try not to give rise to pollution in the first place—that is, to try to minimize waste.

### Objective

To understand some of the factors that cause industrial pollution, and the measures to reduce them.

### Activity

To understand the two approaches discussed above, demonstrate a simple operation to the students.

Ask them to wash a really dirty ceramic showpiece by keeping the tap open and scrubbing the showpiece under the water flow till it is cleaned.

Collect all the wash water in a bucket.

Next, ask them to take some water in a small sized vessel, immerse another dirty showpiece in it and scrub it. Change the water and repeat this once or twice till you get a clean showpiece. Compare the amounts of water used in the two cases.

Explain that this is one of the approaches to pollution control—minimize pollution, rather than create it and then worry about what to do.

Discuss with students the various impacts of industries on the environment. Also discuss the measures that can be taken to eliminate it. While you discuss this, list them down on the blackboard or ask them to note in their notepad.

After this tell the students that they are going to play a game which is very similar to the Snakes and Ladders game. Tell the students that while playing, each should consider himself/herself as an industrialist

who is involved in some or the other kind of production-related processes.

If the game is to be played on the floor, then the squares must be drawn on the floor. The teacher could ask students to write the instructions given on large cards (one instruction on one sheet) and place it on the appropriate square.

For preparing Instruction Cards: Use chart paper and make cards as shown in the sample card. Each card will have house number, message and movement instructions. Place the card, face downward in the appropriate square.

The game should be played with at least two students and not more than four. Three to four such games could be played simultaneously, so that more students can play.

One student at a time must roll the dice and move along as per the instruction given in the squares.

The sequence of the players can be decided by asking each player to roll the dice once—the one with the maximum number will play first, then the second, and so on in decreasing order.

After explaining the game to the players and the sequence of players is decided, ask the first player to roll the dice. He/she should move as many squares as indicated by the dice. If he/she comes to a square that has an Instruction Card, ask them to pick up the card, read the instruction and act accordingly. The chance then passes to the next player and thus the game continues.

The game will end when one of the players reaches the 'Finish' square with atleast 60 points. The player who wins the game should be asked the following:

What he/she felt when he/she was on square with 'move back' remarks and on squares with 'move ahead' remarks.

Also ask how he/she felt when he/she was on square with 'no move' remarks. Did he/she felt helpless due to lack of finance, lack of knowledge about technology?

### Sample Instruction Card

**House 2**

You help in conserving natural resources.

**Move 3 house ahead and gain 6 points**

**14** Natural gas is a cleaner fuel as compared to coal. **Move 4 houses ahead and gain 10 points.**

**16** It helps in conserving rainwater and recharging ground water aquifers. **Move 5 houses and gain 7 points.**

**18** Use of by-products within the same industries helps reduce waste generation. **Move 5 houses ahead and gain 5 points.**

**20** A Common Effluent Treatment Plant treats effluents before they are discharged into water bodies. **No Move.** If there is a CETP then join it.

**23** Sludge from the industrial effluent treatment plant is toxic. You have disposed off the sludge safely. **Move 4 house ahead and get 3 points.**


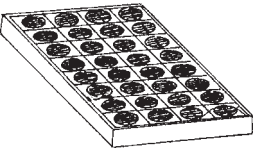

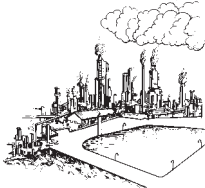
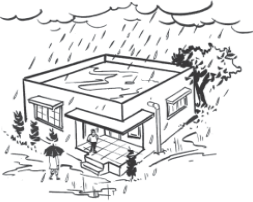

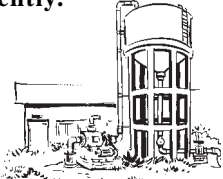

**26** Lead is a carcinogen (causes cancer). Lead-free petrol helps reduce lead levels in the ambient air which could otherwise be harmful to the health. **Move 5 houses ahead and get 6 points.**

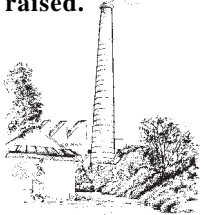



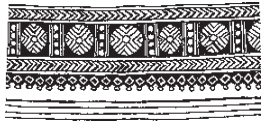
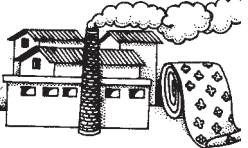
**28** Increasing the height of chimneys carries and disperses the air pollutants beyond the levels immediately harmful to living beings. **Move 1 houses ahead and gain 2 points.**

**30** Solar panels help generate power from renewable, non-polluting sources of energy. **No Move.**

**31** Green belts helps to trap suspended particulate matter and helps in reducing noise and other pollution. **Move 1 house and gain 10 points.**

# Board Game

<p>32</p> <p><b>FINISH</b></p> <p>You are a Green Industrialist.</p>	<p>31</p> <p>My company is surrounded by a belt of green vegetation.</p> 	<p>30</p> <p>I could not install solar panels on the roofs/sheds of the factory.</p> 	<p>29</p>
<p>17</p>	<p>18</p> <p>My sugar factory runs on electricity generated by using bagasse.</p> 	<p>19</p>	<p>20</p> <p>My industry is not linked to the Common Effluent Treatment Plant (CETP).</p> 
<p>16</p> <p>My industry practices roof-water harvesting.</p> 	<p>15</p>	<p>14</p> <p>In my power plant, I use natural gas instead of coal.</p> 	<p>13</p>
<p>1</p> <p><b>START</b></p>	<p>2</p> <p>My company uses water and electricity efficiently.</p> 	<p>3</p>	<p>4</p> <p>Ambient air around my cement factory has dust and soot.</p> 

<p>2 8</p> <p>In my factory, the height of chimneys (stack) has been raised.</p> 	<p>2 7</p>	<p>2 6</p> <p>My company produces lead-free petrol.</p> 	<p>2 5</p>
<p>2 1</p>	<p>2 2</p>	<p>2 3</p> <p>The sludge from my ETP is disposed at a secure landfill site.</p> 	<p>2 4</p>
<p>1 2</p>	<p>1 1</p> <p>My mining company uses open cast mining method for extracting aluminium ore.</p> 	<p>1 0</p>	<p>9</p> <p>My garment export unit uses vegetable dyes and natural colours.</p> 
<p>5</p>	<p>6</p>	<p>7</p> <p>My textile industry has an effluent treatment plant.</p> 	<p>8</p>

**Subject**

Social Science

**Place**

Classroom

**Duration**

45 minutes

**Group size**

5–7 students

**Materials**

Half-Story cards, 25 plain cards (6"x10"), pencils, old newspapers, magazines

The basic resources required for industries come from the environment. It is the environment that provides raw materials for industries, fuel for transport, etc. The environment also absorbs the waste that is created by these activities. That is, the environment is both a source and a sink for industrial activity. Industrial activity cannot focus only on increasing economic profits and ignore concerns of human and environmental well-being. Industrial development cannot take place in isolation from the environment which supports it. If this happens, then industrial development activities cannot be sustained.

**Objective**

To help students explore alternatives in a given conflict situations.

**Activity**

Preparation: For this activity you will need 'Half-story' cards.

Three sample 'half-stories' are given here. Photocopy each half-story depending on the number of groups.

Divide the students into groups of about 5-7. Give one half-story card, five plain cards and a pencil to each group. If more than three groups are there, then the same story card could be given to other groups to get different results.

1. *The Nimipur Sanctuary occupies 550 sq.km of an economically backward state. The sanctuary is mostly covered by bushes. The rest of the areas is flat and dry, except in the monsoon when grass covers it. An extremely rare species of deer which is not found at any other place in the country lives in the sanctuary. The sanctuary is also home to the 'Pakari' tribe who have been living in the areas for generation. The Pakaris are nomadic, moving from place to place in the sanctuary with their grazing herds. A large industrial house has approached the government for permission to start mining in the sanctuary and to build a big industrial complex in the area. It has been found that the land in the sanctuary has good deposits of mineral. Most of the Pakaris feel that the industrial complex will provide jobs and end their poverty. Many people in the state believe that the industrial complex will attract other industries and bring economic development to the state. But there are protests from*

wildlife enthusiasts that mining and industry will destroy the only habitat of the rare deer. Some people feel that the industrial complex may not provide jobs to the unskilled, illiterate Pakaris. They feel that the traditional way of life of the Pakaris will also be in danger as the mining will destroy the land and grazing may no longer be possible.

2. *Chetan Chemical Industries Limited (CCIL) is a large chemical factory that supplies chemical to many industries in the state. More than 5,000 workers are employed in the industry. Waste water from CCIL finds its way into the nearby river. Villagers living downstream have been protesting that the waste water has ruined their agricultural lands, has been responsible for cattle deaths and has also caused skin diseases. The pollution control authorities have recommended that the industry should be closed down as it has been causing severe pollution. The workers' union protests that if the industry closes down, they will lose their livelihoods.*
3. *The government of Surya Pradesh wants to build a massive information technology company outside their capital. They believe that the information technology complex will attract many companies from all over the country and the world, and that this will provide jobs to the people of Surya Pradesh. The area selected for building the complex has about 2,000 trees. Scientists say that this area acts as a 'green lung' to the heavily polluted city.*

Ask each group to read the half-story written on their cards. Tell them that the half-stories represent different environment-development conflict situations. What they have to visualize is 'What is going to happen?' Each group has to think of five possible ways of completing the story, and write each different ending on a separate plain card. They may also illustrate their stories with drawings or with picture cut from old newspapers and magazines.

Give the groups 30 minutes to complete the task.

Ask each group to display their stories on the floor or on the notice board, with all their possible endings. When all the stories have been put for display, the participants can go around the room to look at the stories. The other groups can comment upon or add new ideas to the stories.

## **Discussion**

How do industrial decisions impact the environment?

Decisions that consider only short-term economic gains may result in long-term environmental, social and economic losses. For example,

large-scale hydroelectric projects may provide employment, electricity and water for irrigation, but often are not viable in the long run. They may lead to dislocation of people, and usually cause significant environmental damage.

What could be the principles to guide decision making in such conflict situations?

Resolving such conflicts is not easy. There are trade-offs to be made. For example, if a heavily polluting industry repeatedly flouts pollution control norms, it may have to be shut down. This will lead to the workers of the industry losing their jobs. There are no ready-made answers to these conflicts, but some broad actions may help resolving them. These include:

**Information dissemination:** Information on all aspects of the project including justification costs, alternative options evaluated, the possible impacts and the proposed remedial measures, etc. need to be widely disseminated. Information presented in a highly technical format may not be of use to people who may not understand the technical terminology use. It is crucial that information has to be present in a manner that can be understood by all people who affect and are affected by the project.

**Involving all relevant groups:** All the groups of people who affect and/or are affected by the project—for example, the implementation agency, the project affected persons, NGOs, the scientific community, etc., have to be involved in efforts to find solutions to conflict. The interests of all these groups need to be represented and considered.

# More About Industries



It is a significant achievement that India is one of the ten most industrialized nations of the world. Industrial activity is essential to generate goods for the development of the nation, to meet the needs of people, and to generate employment. At the same time, it must be accepted that industrial activities release pollutants that contaminate air, water bodies and land, and adversely affect the quality of human and other life.

While industries are vital for development, it is equally important to be aware of the impacts of industries on environment. A proper understanding of this can help ensure that these impacts are minimized.

## How Industries Affect the Environment

The first and most obvious way in which industries affect the environment is the pollution that factories cause. The most visible are the water pollution, solid waste and air pollution than can be felt and seen. The nature and composition of industrial waste and pollutants widely vary from industry to industry and even within the same industry. The waste generated depends upon the raw materials, processes, and operating factors. Different industries generate different types of pollutants. For example, food processing industries produces organic wastes that are readily decomposed but have high biological oxygen demand (BOD); pulp and paper mills produce toxic compound and sludge; electronic industry produces high level of heavy metals such as copper, lead, manganese, etc.

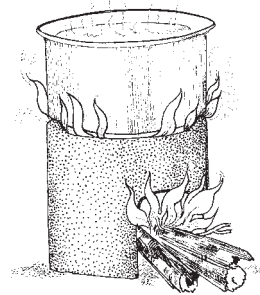
Apart from the pollution, industries affect the environment in other ways too. How else do industries affect the environment and what are these other kinds of environmental impacts? Let us examine some of these factors.

**Raw materials:** A most basic need of any industry be it paper industry, textile industry, cement industry, etc. is raw material. A factory can turn out anything: aeroplanes or cloth or paper. But it needs raw materials: for instance, aluminium to make an aeroplane; natural or synthetic fibre to make cloth; wood pulp to turn into paper etc. The extraction and mining for raw materials, and the processing of

### Factory at Home

Think of the kitchen as a factory turning out food. Cooking is a production process. The raw materials include vegetables, cereals, pulses etc. The processes involved are frying, boiling, baking etc. The desired output is the food and the undesired outputs include smoke (from wood/coal stoves), solid wastes like coconut husk, vegetable peels, etc. water from washing (effluents), and the waste heat from the stove. The energy source is LPG, or wood or coal. Water is needed to wash and clean the raw materials.

Similarly, a manufacturing industry takes in raw material, processes it, and puts out both the product (which is the desired result of this production process), and the by-products (including pollution, which are a necessary but undesired outcomes of the production process). In the process of production, the industry consumes raw materials, as also energy, water, etc. The product that is made is packaged and transported to where it will be sold and used by consumers.



<b>Industrial Contribution to Pollution by Subsector in India</b>						
<b>Sector</b>	<b>Share of Industrial Output</b>	<b>Share of Total Industrial Pollution (%)</b>				
		<b>Toxic</b>	<b>BOD</b>	<b>Particulates</b>	<b>Sulphur</b>	<b>Nitrogen</b>
Iron and steel	12.5	23	0	23	2	5
Industrial chemicals	7.5	44	29	8	11	15
Non-ferrous metals	2.1	6	10	3	1	0
Other chemicals	6.8	6	1	1	0	1
Food products	15.3	1	38	11	4	8
Paper and pulp	2.0	2	19	4	15	11
Non metallic mineral products	3.4	1	0	32	3	10
Petroleum refineries	6.8	6	2	6	31	21
Textiles	11.1	3	1	6	30	23
<b>Total</b>	<b>67.5</b>	<b>92</b>	<b>100</b>	<b>94</b>	<b>97</b>	<b>94</b>

Source: State of the Environment, India, UNEP 2001



the raw material, e.g., ores into the metal, have major environmental impacts.

For instance, if limestone is to be mined for cement production, large areas of land will get degraded. If cotton is to be grown for making cloth, acres of agricultural land may have to be heavily sprayed with chemical pesticides and fertilizers to get a good crop. If wood is to be fed to a paper factory, hectares of trees or bamboos will have to be cut down. In the process of making synthetic yarn to feed a factory, pollution in the production of that yarn would have already spoilt the environment.

**Transport of raw materials:** Getting the raw material that is extracted from the site/field and

other inputs to the factory concerned, involves transportation. And this takes its own toll on the environment in terms of the fossil fuels consumed and the pollution caused by the transport.

**Other inputs:** The production process needs inputs other than just the raw materials. Most crucially, most production processes need water and power. They may draw water from either surface water sources in the neighbourhood (e.g. river, lakes etc.), or they may tap groundwater sources. In either case there are serious



environmental impacts to be considered, specially if the operation is a large scale or a water intensive one. For example, if a factory comes up in a semi-arid area, where groundwater levels are already low, the factory may draw so much water that drinking water availability might reduce for the local communities. After all, it is the same limited ground water that both would be trying to draw.

The other essential input for any production process is power. Power, whether generated in a hydel plant, thermal plant, nuclear plant, or by any other means, has serious impacts on the environment. So every kilowatt of power that the factory draws has environmental impacts. (See chapter 'Energy' for more information on impacts by power plants)

**Production processes:** Of course the production process itself has impacts on the environment. It may generate pollutants and waste material in the form of liquids, solids, gases or even noise or heat. Some of this may be toxic or hazardous and long lasting. Some of it may pollute the immediate environment; some may travel for hundreds of miles into another state or country. Industries also

often contribute to noise pollution through the production process, e.g., from the running of motors etc. This also is a form of pollution. (See chapter 'Pollution' for more information on Noise Pollution).

**Finished goods:** After the production process, the product has to be packaged and transported. This again impacts the environment. Packaging is getting more and more resource-intensive e.g. 10 biscuits are packed in a whirl of corrugated paper and then in a plastic sheet, which may then be put into a cardboard carton. Each of these packing materials has gone through its own processing cycle. After packing, the ready products have to be transported to the various, far-flung markets. Transportation also uses up resources.

**Environmental impact of use:** When a product is used, it affects the environment. And this will continue to add to the garbage burden of the world. For instance, when a scooter is bought, it will consume a large amount of fossil fuels to run it. Similarly a washing machine will need water and electricity to run it. This process will continue throughout the life of a product.

## Hazardous Waste

**Maharashtra:** The Thane-Belapur industrial area, in Maharashtra where about 1200 industrial units are housed on a 20 km stretch close to New Mumbai, creates more than 100 tonnes of solid waste every day. About 85 per cent of this waste is either acidic or alkaline in nature. The area also produces 5 tonnes of waste everyday, which is difficult to treat because of its halogen content. The bulk of hazardous waste in this area is co-disposed with municipal waste in municipal dumpsites. The water bodies in the vicinity of this industrial area are polluted. The sediment in the Ulhas river has registered high levels of mercury and arsenic. Ulhas river empties into Thane Creek at its northern end. As a result, Thane Creek is one of the most polluted seawaters in the country.

Source: State of the Environment, India, UNEP 2001

**Gujarat:** The Ahmedabad-Vadodara-Surat industrial belt has over 2000 industrial units in the organized sector and more than 63,000 small scale units manufacturing chemicals like soda ash, dyes, yarns and fertilizers. Vapi in Valsad district has around 1800 units of which 450 fall in category of polluting industries. Industries in all these areas usually dump their wastes in low lying areas within 2 km radius. As a result, a major illegal dump yard has sprung up on the banks of river Daman Ganga. Indian Petrochemical Corporation Limited (IPCL) at Vadodara dumps 1800 tonnes of hazardous wastes every month at a site near Nandesari. The IPCL dumpsite is on hill. During rainy season, the hazardous constituents of these wastes are washed down into the river.

## Reducing the Environmental Impact

In order to minimize environmental problems, there are guidelines and checks to be followed before setting up any industry and while running the industry.

**Location of the industry:** A polluting industry should not be located in an ecologically sensitive area or near human settlements. For example Mumbai may have excellent infrastructure and markets, but a highly polluting industry cannot be

located in such a densely populated place. The Government of India has set down guidelines for the setting up of certain industries. Under these guidelines, for setting up the industries mentioned in the guidelines, environmental clearance has to be obtained from the government. The guidelines include pointers on location e.g. certain areas need to be avoided while setting up certain types of industries. These include ecologically sensitive areas, coastal areas, major settlements, flood plains etc. The guidelines also specify certain conditions which must be followed in the setting of these industries: e.g. no forest land or prime agricultural land can be cleared for setting up these; enough land should be acquired so that there is space to set up treatment facilities, for storage of solid waste etc.

**Environment Impact Assessment (EIA):** Prior to setting of certain large-scale projects, EIA is needed. The purpose of EIA is to identify and evaluate beneficial and adverse effects of development projects on the environment. It is undertaken for projects that are very large and/or those which may be particularly damaging to the environment.

**Environment Management Plan (EMP):** Before a polluting industry becomes operational, EMP needs to be prepared. This plan indicates what environmental protection measurements have been or are proposed to be taken during and after the commissioning of the project. This management

### Industrial Accident

One of the world's most serious industrial accidents took place in India—this was the accident at the Union Carbide Factory at Bhopal. On December 4, 1984 when the city was asleep, a deadly chemical blanket spread over it. The chemicals came from the Union Carbide Factory. Something had gone wrong in one of the storage tanks and close to 40 tonnes of a deadly chemical—methyl isocyanate (MIC)—escaped into the air.

How could such a tragedy have happened? There were many things that contributed. One reason was that the safety measures put into this factory which made and used such hazardous substances, were not adequate and did not work when they were most required. Another factor that contributed was that there were so many people living so close to such a factory. Moreover, there was little information available about what the chemicals being processed in the factory were, what effects they could have, and how they should be treated. As a result, when MIC leaked out, few people even knew what gas it was. Doctors did not know how to treat the patients. Helpless citizens did not know what precautions to take. City authorities did not know how to handle this midnight crises.

The controversy about whether the victims got enough money as compensation still goes on. But can money compensate for lost lives, lost health and sick babies? As a result of Bhopal, India and other countries have made stricter laws regarding such industries. But there is a long way to go to ensure that there are no more Bhopals.

### Occupational Health

Sometimes the place of work or the nature of work may lead to ill health. This phenomenon of the impact of the work environment on the physical, mental or social well being of the worker is called **occupational health**. At workplaces there are several factors that can be dangerous or cause damage to the health of the worker. These are called **occupational hazards**. For example, a farmer is exposed to harmful chemicals present in the pesticides as well as fertilizers; a teacher is exposed to chalk dust, etc.



plan is based on consideration of resource conservation and pollution abatement and looks at how wastes are going to be managed, the house-keeping systems, and disaster planning, etc.

**Laws and Rules:** Once an industry starts operating, there are rules and regulations to ensure that it does not harm the environment. These rules and regulations are enacted under certain legal Acts and specify such things as the quality and quantity of effluents, etc.

Some of the important Acts under which these rules and regulations are framed include: the Water Act for the Prevention and Control of Water Pollution; the Air Act for Prevention, Control and Abatement of Air Pollution; and Environment Act for Protection and Improvement of Environment. (See Annexure 1 'Environmental Laws')

It is not only the law that can control pollution. Some of the other approaches which can minimize the environmental impact of industries include:

**Eco-efficiency:** This can be understood as the production of goods in ways that damage the environment less and use less resources, without increasing the cost of the goods. Eco-efficiency needs to be looked at as whole. Thus, it could include: reduction in the amount of raw materials used; reduction in the amount of energy used; reducing the pollution; trying to recycle materials; using renewable materials.

### **Pollution Control**

The Central Pollution Control Board (CPCB) is an autonomous body of the Ministry of Environment and Forests, Government of India. CPCB, along with the State Pollution Control Boards and Pollution Control Committee, has the responsibility for implementing the legislation relating to prevention and control of pollution. These bodies develop rules and regulations which describe the standards of emissions and effluents of air and water pollutants and noise levels.

Think of a familiar example. At home, if potatoes are boiled in a pressure cooker they take less time to cook, and therefore consume less fuel than if they were to be boiled in an ordinary vessel. So in a way, a pressure cooker is a fuel-saving and therefore environmentally friendly technology. Similarly there are also environment-friendly processes: if one were to pre-soak *dal* and then boil it, it would take less time than if *dal* were to be cooked without pre-soaking. Similar changes can be made in industrial technologies and processes too.

**Cleaner Production Practices:** The concept of Cleaner Production (CP) is to minimize or eliminate waste and emissions at their source, rather than treat them after they have been generated. CP conserves raw materials and energy, eliminates toxic raw materials and reduces the quality of toxicity of all emissions and wastes before they leave the production process. It reduces environmental impacts throughout the entire product life cycle from raw material extraction to waste disposal.

An everyday example of cleaner technology would be the use of a solar water heater rather than a wood stove or LPG. A wood stove gives out smoke; LPG, in its extraction and processing gives rise to pollution. A solar water heater uses renewable energy and gives out no pollution. If industries gave more stress on such cleaner production, they would have to clean up less pollution and put less stress on the environment.

**Eco-Industrial Networking:** Eco-industrial networking is rapidly becoming an important new approach for industries, communities and businesses to improve their competitiveness, economic viability, human and ecosystem health.

Eco-industrial networking involves developing new local and regional business relationships between the private sector, government and educational institutions in order to use new and existing energy, material, water, human and infrastructure resources to improve production efficiency, investment competitiveness, community and ecosystem health.

“By collectively managing environmental and energy issues, eco-industrial park members can enhance their environmental and economic performance and, as a result, achieve a combined benefit that is greater than the benefits each company would realize from optimizing only its individual performance.”

Eco-Efficiency Task Force Report, U.S. President’s Council on Sustainable Development, 1996

Source: <http://www.greenroofs.ca/cein/whatsein.html>

Such networking is in the form of associations of industries. These types of industrial associations facilitate implementation of cleaner production technologies and waste minimization options in their member industries.

### **What Can Individuals Do?**

Industries produce goods and services because people want them. If there were more demand for environmentally friendly products, industries will have to produce them. But how would an individual

consumer know if a product is environmentally friendly? In order to help in this, world-over there is a movement to ‘ecomark’ products. Under such a scheme, an agency designated by the government, after satisfying itself that a product has been produced in an environmentally friendly way, will certify it. Then the packaging of the goods will display a special sign so that consumers will know that it is environmentally friendly. As of now in India, while there is a provision for Ecomark, there are few products which are marked with Ecomark.

Consumers may also choose not to consume, or to reduce consumption of certain goods and services. For instance, someone who is environmentally conscious may choose not to accept plastic bags at every shop they go to, but rather carry their own cloth bags. They may choose to use only organic manure in their gardens, rather than chemical fertilizer. Responsible consumers can make a difference to what is produced and how.

**As a consumer ask before buying anything: Where does it come from? How is it disposed of? Will it last? Can it be fixed? Is it really needed?**