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# Waste Reduction Always Pays

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**Abstract:** Dow has made waste reduction a priority at its facilites around the world. In 1986, the company formalized its waste reduction under a program called WRAP-Waste Reduction Alwasy Pays. The objectives of WRAP are to seek out cost effective projects that reduce waste to the environment, measure and track performance, and recognize employee excellence.

The successful examples of Dow's WRAP Program are introduced as follows :

1. By-Product Feedstock Optimization.
2. Plastics Reclamation.
3. Glucol II Plant Absorber Water Upgradele
4. Loss Reduction Project.

## 1. INTRODUCTION

The Dow Chemical Company (Dow) manufactures and supplies more than 2,000 products and services, including chemicals and performance products, plastics, hydrocarbons and energy, and consumer specialties-which include agricultural products, pharmaceuticals and consumer products. The company operates 181 mamufacturing sites in 32 counties, and employs 62,000 people around the world.

Almost all manufacturing processes produce some waste, but we are working vigorously to ensure that waste is held to an absolute minimum.

Dow recognizes that one of the most pressing issues facing the world today is protection of the environment. Dow's standards and practices are best summed up by the company's Environmental Policy :

"The Dow Chemical Company is committed to continued excellence, leadership and stewardship in protection the environment. Enviromental protection is a primary management responsibility as well as the responsibility of every Dow employee.

In keeping with this policy, our objective as a company is to reduce waste and achieve minimal adverse impact on the air, water, and land through excellence in environmental control."

Dow is putting the Environmental Policy into practice in numerous ways and thousands more Dow people are active in various environmental activites in their communities.

This paper is prepared to introduce Dow's "Waste Reduction Always Pays (WRAP)" program which is one of Dow's overall program to environment and its successful examples.

## 2. WHAT IS "WASTE RUDCTION ALAWAYS PAYS"?

Waste reduction is key component of any good waste management program. Dow has practiced waste reduction for many years. However public perceptions are that industry in general, has done little in this regard. Hence a change in approach was required ; a more logically planned and documented approach so that success can be prioritized, better monitored and better communicated to the community and government.

In 1986, Dow has just annonunced a bold new program called Waste Reduction Always Pays to streamline and formalize our efforts toward our waste reduction golas.

Dosw's WRAP program is a multi-media waste reduction program focusing on source reduction and recycling activites. We take a balanced approach to our waste management pratices.

The golas of WRAP program are :

- To reduce waste to the environment
- To provide incentives for waste reduction projects
- To provide recognition for those who excel in waste reduction
- To re-emphasize the need for continuous improvement by recognizing opportunities in waste reduction

Dow developed an action plan as listed below to implement WRAP program effectively.

- Inventory all process losses to air, water and land
- Identify sources, establish priorities, quantify losses and ratio to production
- Evaluate environmental impact and risk
- Set action priorities
- Determine cost-effcetive actions
- Set reduction goals
- Determine resources necessary to accomplish goals
- Track and communicate performance and plan for future reductions

By applying these action plans, the facility manager can identify the proper operation to work on and assure that proper planning and allocation of resources are accomplished.

Each facility within Dow has developed an inventory of process losses to the environment and set specific reduction goals and than tracks and to the above action on plan.

As an example of emission inventory and reduction goals, Dow's Ulsan latex plant surveyed emission inventory in 1991 and has plan to reduce 60% of emission amount by 1998.

For your reference, refer to Appendix A1~A5.

Dow has had remerkable success at many of its plant often reducing its generation of all environmental pollutants and hazardous wastes. Dow belives that by actively pursuing waste reduction opportunities we will reduce our waste management cost, improve operations productivity, demonstrate to the public our commitment to environmental protection.

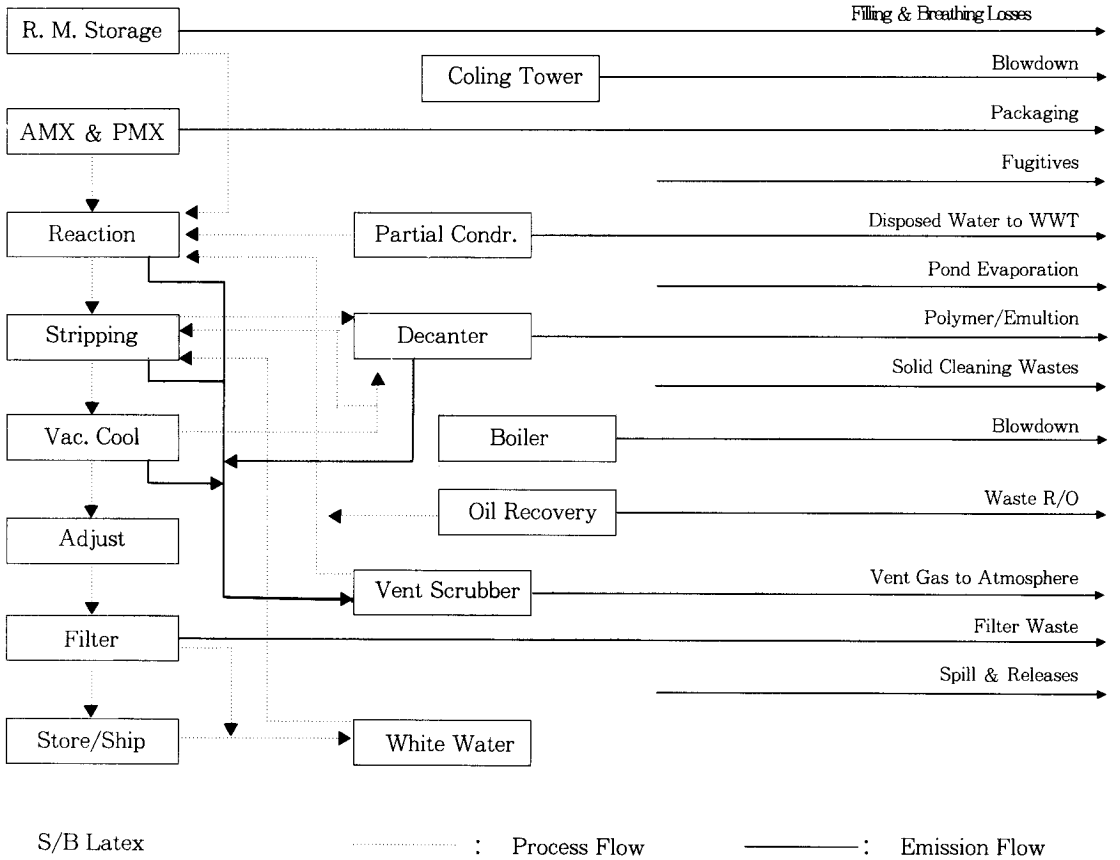
### A-1. SUMMARY OF EMISSION INVENTORY ULSAN LATEX PLANT

| |
|---|
| As a result of our emission inventory survey staus in 1991, air emission quantity is 133,400 lb /yr, water emission quantity is 112,300 lb/yr, and land emission quantity is 246,100 lb/yr, That is, total 491,800 lb/yr is discharged from Ulsan latex plant. |
| After detail review of each items, Ulsan plant set the goal to reduce the emission amount. Up to 1998, we have plan to reduce total 294,100 lb /yr. This means that 60% of emission amount will be decreased in 1998. |
| In order to achieve this goal, we need to invest about US $ 731, 000 totally. |

A-2. EMISSION INVENTORY ULSAN LATEX PLANT

| | EMISSION QUANTITY(lb/yr) | | INVESTMENT | REDUCTION |
|---|---|---|---|---|
| | 1991 | 1988 | (US $) | (%) |
| AIR EMISSION | 133,400 | 30,600 | 530,000 | 77 |
| WATER EMISSION | 112,300 | 20,500 | 129,000 | 82 |
| LAND EMISSION | 246,100 | 146,600 | 72,000 | 40 |
| TOTAL | 491,800 | 197,700 | 731,000 | 60 |

A-3. Emission & Process Index Flow Sheet Ulsan Latex Plant




## 3. SUCCESSFUL EXAMPLES OF WRAP

In this chapter, you can find the successful examples of Dow's WRAP program.

### 3. 1. By-Product Feedstock Optimization

#### 3. 1. 1. Opportunity

Dow manufacturing processes produce by-products that represent a process yield loss and require disposal. In available and potential by-products-currently being dsposed of-for

A-4. EMISSION INVENTORY-ULSAN LATEX PLANT

| Air Emission(lb/year) | 1991 | 1998 |
|---|---|---|
| -Thank Filling/Breathing Loss | 200 | 200 |
| -Fugitive Emission | 30,400 | 30,400 |
| -Vent Scrubber Emission | 101,600 | 0 |
| -Process Vacuum System | 500 | 0 |
| -Pond Evaporation | 700 | 0 |
| -Sampling Emission | 0 | 0 |
| Total | 133,400 | 30,600 |
| Water Emission(lb/year) | | |
| -Waste Recycle Oil | 72,800 | 0 |
| -Decanter Polymer/Emulsion | 37,500 | 18,700 |
| -Spill and Releae | 1,300 | 1,300 |
| -Organic Emission to Water | 700 | 500 |
| Total | 112,300 | 20,500 |
| Land Emission(lb/year) | | |
| -Filter Waste | 34,900 | 28,000 |
| -Polymeric Solid | 97,100 | 48,500 |
| -Packaging Material | 3,100 | 3,100 |
| -Empty Drum | 109,500 | 65,500 |
| -Process-related Solid | 1,500 | 1,500 |
| Total | 246,100 | 146,600 |
| TOTAL EMISSIONS (lb/yr) | 491,800 | 197,700 |
| %REDUCTION | | 60 |

dsposed of-for use instead as feedstocks in the company's global perchloroethylene/carbon tetrachloride plants. Diverting these by-products to production would reduce disposal costs and permit primary raw materials to be freed up for sale or use.

### 3. 1. 2. Action

The By-Product Feedstock Optimization Team evaluated and prioritized actions necessary at the five Dow plants to displace all or most of the primary feedstocks with by-product feedstocks. They identified the by-product streams with potentical for feedstock use, evaluated any plant or production changes necessary to use the by-products, set manufacturing specifications based on this research, handled the logistical problems of transporting the by-products, and planned modifications to plant operation in some cases. They also set the program in motion to provide perpetuation of optimzation activities after the team disbands.

### 3. 1. 3. Results

Since 1986, more than 100 million pounds of by-products already have been diverted for use as manufacturing feedstock. This program is saving money for Dow in several ways :

-Produces of by-products avoid the cost of disposal

-Neutralization of exess acid, created from by-product incineration, is avoided

-Outside purchases of hydrocarbons for feedstock aren't needed, and ethylene dichloride formerly used as feedstock is freed up for sale or for the manufacture of vinyl chloride monomer

-Incineration demands are reduced as by-products are recycled

'A-5. EMISSION REDUCTION RLANS-ULSAN LATEX PLANT

| Emission Source | Actul Emission(lb/yr) | Project Description | Year | Cost (US $) | Reduction (lb/yr) | Cost/lb Red. |
|---|---|---|---|---|---|---|
| Vent Scrubber/Vacuum System | 102,100 | Install TOX unit | 1995 | 500,000 | 102,100 | 4.90 |
| Pond Evaporation | 700 | Revise process for no spill | 1993 | 30,000 | 700 | 42.86 |
| Organic Emission to Water | 700 | | | 98,000 | 200 | 490.00 |
| *Cooling Tower Blow-down | | Install side stream filter | 1998 | 30,000 | | |
| *Boiler Blowdown | | Install deionizer | 1997 | 43,000 | | |
| *Raw Water Backwashing | | Install intermedeate filter or reverse osmosis | 1996 | 25,000 | | |
| *Process Water | | Reuse | 1992 | Completed | | |
| Waste Recycle Oil | 72,800 | Burn it in the boiler | 1993 | 200,000 | | |
| Decanter Polymer/ Emulsion | 37,500 | Install Capacitance type probe | 1992 | 11,000 | 72,800 | 0.27 |
| Filter Waste | 34,900 | Change the control valve for VCN, | 1992 | 8,000 | 18,800 | 0.59 |
| | | AA and R/O | | | 6,900 | 1.16 |
| Polymeric Solid | 97,100 | Install the desuperheater | 1992 | 20,000 | 48,600 | 0.41 |
| Empty Drum | 109,500 | -Replace Proxel to Kathon<br>-Reuse IBC of seed latex | 1992 | 44,000 | 44,000 | 1.00 |
| Total Reduction by 1998 | 294,100 | lb/year 60% Reduction | | | Total Cost (US $) | 731,000 |

-Plant otherwise limited by feedstock availability are able to increase production capacities by using by-product feeds.

### 3. 2. Plastics Reclamation

#### 3. 2. 1. Opportunity

The Lousiana Division produces about one billion pounds of polyethylene plastic resin pellets a year. Pellets are sold as intermediate raw materials to thousands of processors around the country who remelt the pellets and form them into plastic products. In the manufacturing and product handling process, there are some unavoidable pellet losses at different stages. These pellets can by picked up by rainwater and washed out the the Mississippi River and into Gulf of Mexico. When floating in water in a marine environment, polyethylene pellets look like fish eggs-a delicacy for a variety of marine life, particulatly birds. The fact that polyethylene floats does cause marine environmental problems, but this physical property can also be used as anvantage to prevent its escape.

#### 3. 2. 2. Action

A Weir Collection System was installed to collect pellet losses. The system takes advantage of the pellet's buoyancy and traps them so they can be sent back into the plant for recycling. We've also prevented spills form package ruptures by creating fully contained units of packaged pellets which are much

easier for fork lift drivers to handle in the warehouse than individual bage.

#### 3. 2. 3. Results

During the past 10 years, we've implemented a number of steps to prevent in-house plastic resin pellet losses. With our "drain and reclaim" method, plastic resin pellets are trapped at strategic locations, recovered on a continuous basis, dewatered, and recycled. This recovery system is capturing about 500 pounds of pellets a day that otherwise could have found their way into the marine environment.

### 3. 3. Glycol II Plant Absorber water Upgrade

#### 3. 3. 1. Opportunity

The purpose of this project was to provide a closed-loop absorber water cooling system. Absorber water is water that is cross-flowed through a gas stream to absorb ethylene oxide. The previous system utilized a conventional cooling tower that created numerous problems due to its open nature. The open cooling tower resulted in product losses to the environment, system contamination from the atmosphere, and equipment fouling due to poor water quality.

#### 3. 3. 2. Action

The new system required the installation of high-efficiency heat exchangers that use less water in the cooling process and a water storage tank that makes it possible to recycle the water. The WRAP team also converted the water pH control system from a caustic system to a cleaner and more efficient amines-based system.

#### 3. 3. 3. Results

This projcet eliminated a significant loss ethylene glycol to the atmosphere and surrounding process area(Ethylene glycol is used in antifreeze and polyester fiber). The projcet also converted six million pounds per year of off-grade ethylene glycol into an industrial-grade ethylene glycol. In addition, installing the pH contol system resulted in fewer cleanings and reduced ethylene glycol load to the waste water. Another benefit of the project was that it reduced an ethylene glycol bottoms stream that had previously required biological treatment.

### 3. 4. Loss Reduction Project

#### 3. 4. 1. Opportunity

In the Herbicides Plant, a solvent is used in the recovery of raw materials and treatment of waste water, and also as a heat transfer agent. By comparing vent emission data with plant material balance, employees became aware of the opportunities to reduce fugitive emissions.

#### 3. 4. 2. Action

The first step in reducing solvent loss was to identify those areas of fugitive emissions. Though employees found some solvent loss through process vents, the most substantial amount of solvent loss appeared to be associated with evaporation within the plant's waste water collection system.

After identifying these emission areas, these steps followed :

—A sample valve was added, which allowed the exact sample amount of solvent to be collected without prior flushing into the plant's waste water collection system.

—Employees elminated the use of a semi-batch filter to remove the suspended solids from a decanter.

—An air line was added to transfer filter contents back into the process before changing filter bags.

—Plant employees added pressure and flow transmitters on the vent condenser to warn of abnormal conditions.

—The removal of solvent from the vottom of a recycle water tank was automated so that

evaporation losses to the vent system would be minimized. Also, an upstream decanter level control was adjusted to put less solvent into the tank.

### 3. 4. 3. Results

Through a combined effort, Herbicides Plant employees reduced solvent loss by approximately 92 percent through a variety of cost-efficient modifications to the system.

## 4. CONCLUSION

Within Dow, WRAP continues to be successful. Not only are wasted being reduced, it is being achieved in cost effective manner.

Dow believes that waste reduction will become the new environmental ethic and voluntary waste reduction programs can work without government regulation.

With WRAP Dow continue to take a comprehensive approach to reduction waste to the air, water and land with one overall goal.