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The Procter & Gamble Company has over 30 plants and mills engaged in the production of pulp and paper, soap and detergent, a large variety of food products and toilet goods throughout the United States. One form of pollution control facility that has been or will be installed in all these plants within the next two years is spill protection. The questions arise as to what is spill protection and why is it necessary? It is necessary to protect the environment since losses of materials by industry to waterways through accidents, misoperations of equipment, or some form of mishap cause many water pollution incidents each year. According to reports of the Environmental Protection Agency (EPA), more than half the major recorded fish kills in recent years resulted from spills being discharged directly into storm sewers (Rivers) or sanitary sewers (Sewage Treatment Plant) rather than from inadequate treatment at the sewage treatment plants.

Typical spills and losses result from leaks or ruptures of storage tanks or pipelines, overfilling of a tank or pipeline, and failure of a valve or fitting.

Now that we have answered the question as to the need for spill protection we return to the basic question: What is spill protection? The answer to this question can be summed up as follows: Spills are not planned but do occur as a result of human error or mechanical failure. To completely eliminate the chance of a spill occurring is impossible so we must look at the next best alternative:

How to Protect Against the Adverse Effects of a Spill

Thus, spill protection is actually protection against the adverse effects of a spill. This protection can be accomplished by either:

1. Containing the spill at the source, or
2. Diverting the spill to a holding area for final disposal.

Both of these philosophies protect the environment from the adverse effects of a spill but each is unique in the way that it is accomplished.

Containment Curbs

In containing a spill at the source it is necessary to construct curbs or dikes around spill prone areas, such that there is no discharge from the area unless it be deliberate.

As can be seen in Figure 1 the curb system in the usual case consists of constructing a low raised wall or dike around the perimeter of the area. The shallow basin formed by this wall constitutes a catchment volume for spilled or escaped material.

A key feature of such curb containment systems is that gravity discharges from the curbed area are prohibited. The ideal provision for transferring the drainage from this containment area to a sewer is a manually starting pump. Where separate sewer systems (storm and sanitary) are provided, pump connections to the sanitary or process wastewater sewer for polluted wastewater and connections to a storm sewer for uncontaminated rainfall would be provided. A loadout or recovery connection can also be provided for very concentrated spilled material. The height of the curbs around this area is dependent on:

1. The volume of the largest single tank in the curbed area. If possible, the curbed area should be able to contain this volume.
2. The maximum anticipated rainfall expected during an unattended period.

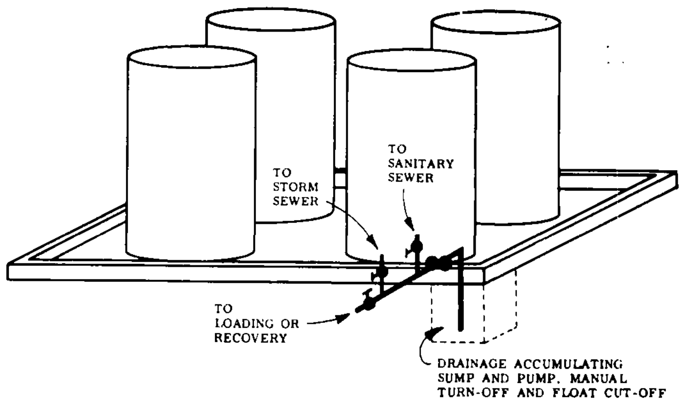

Figure 1

This system relies on the operator making a decision to discharge the uncontaminated water only into the storm sewer and the contaminated water into the sanitary sewer.

Let us now look at the second method of spill protection: draining spill prone areas to a large collection tank (See Figure 2). A sewer line collects all stormwater runoff and/or spills from the spill prone areas and carries it to a collection tank for final disposal. The minimum size of this tank should be such that it will contain at least the entire contents of the largest tank on the mat plus a specified rainfall. In designing such a system, care must be exercised to insure only the drains from spill prone areas discharge into the spill collection sewer and tank. Careful analysis of the drains discharging to the tank will help minimize the size of the tank.

Having discussed the theoretical concepts of spill control, I would like to now switch my discussion from the theoretical to the actual and describe the new spill control system recently constructed at our Iowa City plant and acquaint you with how this spill system was devised.

The reason for constructing a spill protection system at our Iowa City Plant was to provide a fail safe means of retaining any material accidentally spilled in our tank farm or processing area. Even though we have never had a damaging

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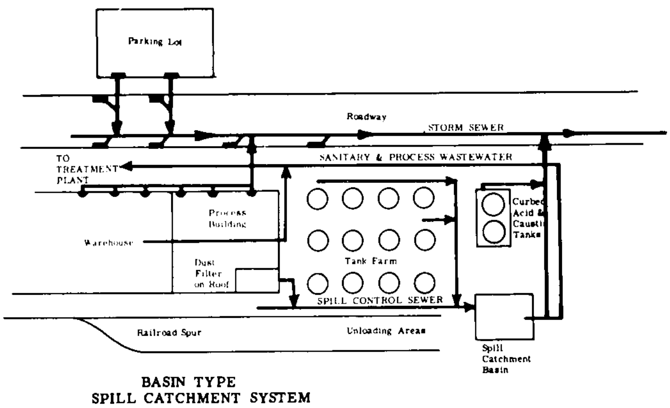

Figure 2

spill in the plant's 15 years of existence, we took this step to further minimize the possible results of human error or equipment failure.

After the decision was made to construct a spill control system, the next decision that had to be made was the type of spill system: containment curbs or diversion to a collection tank. Since both of the systems provide adequate spill protection, the decision as to the type of system was based primarily on operational characteristics of the system. We decided that a collection tank would provide the best spill protection system because:

a. in this instance, the collection tank provided a fail-safe method of spill control since railroad tracks were present in the tank farm. A containment curb system cannot adequately spill protect an area where there are railroad tracks since there are openings in the curb required for the tracks which would provide a potential drainageway for any liquid in the area.
b. the containment curbs would require too much operator attention.
c. accumulated water in the curb would impede plant operations.
d. the containment curbs would make it difficult to keep the mat area clean.

The spill control system for our Iowa City Plant consisted of two main parts:

1. Tank farm area—Spill Collection Tank
2. Interior Spill Control

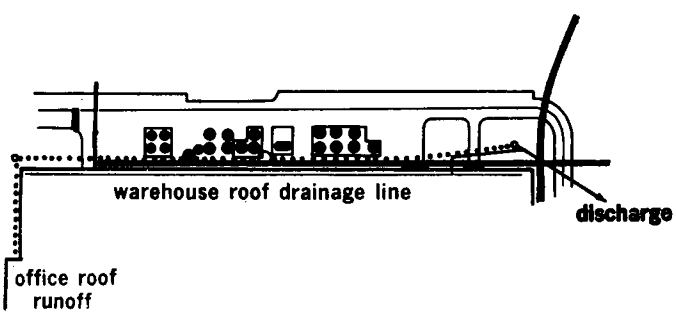

Figure 3

Before this spill protection program was initiated, our tank farm contained drains that discharged to the sanitary sewer and storm sewer. If a spill were to have occurred it could discharge directly to either of these sewers. Storm sewer runoff from the tank farm, west warehouse roof, and office roof discharged to the storm sewer as shown in Figure 3. It then flowed into a swale south of our plant which eventually discharges into the Iowa River.

By constructing the spill protection system our tank farm now took on the following appearance: It was bounded on the

south—by an existing ramp and covered fuel oil trench plus a small bump just south of the aforementioned ramp.
west—by the existing crown in the service road.
north—by the increased elevation of the existing service road and existing E-W rail line.
east—by the existing wall of the manufacturing plant.

As shown in Figure 4 all the drains in this area discharge into an eight inch sewer line. Any spills or rainfall occurring in this area now flow via this spill collection sewer to the spill collection tank for containment prior to being pumped to either the drainage swale, a tank truck or the sanitary sewer for final disposal.

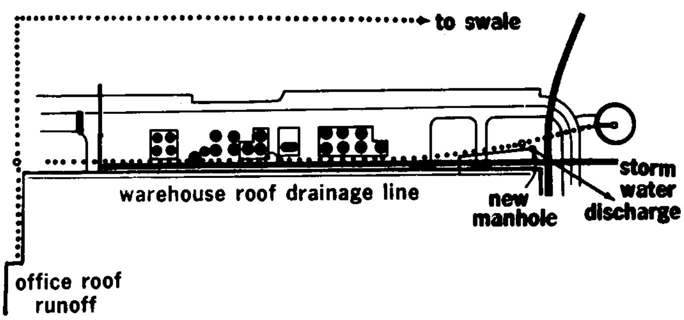

Figure 4

To minimize the amount of rainwater entering the collection tank we diverted the west warehouse roof storm drains and office roof drains to two separate sewers. This water was diverted because it was clean stormwater that did not originate in a spill prone area.

A closer look at this system reveals that the collection tank has a containment volume of 71,000 gallons. This volume enables the basin to contain:

1. The entire volume of the largest tank in the tank farm area.
2. All of the rainfall runoff from the tank farm area during a 3 inch rain.

An overflow system was designed for the collection tank to prevent floating debris or contained liquids with specific gravities less than 1.0 from overflowing the top of the collection tank and discharging to the swale if 3.00 inches of rainfall is surpassed in 24 hours. To accomplish this the inlet of the overflow system was placed below the maximum water level in the tank. Thus, if the tank overflows, floating and settleable materials would not be discharged as a result of the inlet positioning.

A pump was installed in the tank to pump its contents to either the swale, sanitary sewer, or a tank truck. Pumping to these different disposal outlets is accomplished through proper valving of the pipeline leading from the tank.

Thus, with the completion of this construction in January, 1972, our tank farm area was spill protected and we were protected against the adverse effect of a spill. During the construction of our spill collection tank, we also designed and installed an interior spill control system.

Since floor drains in our processing area were directly connected to the sanitary sewer, we felt an interior spill control system was necessary to prevent any spills in this area from entering the sanitary sewer and possibly overloading the Iowa City Sewage Treatment Plant. This spill system consisted of constructing either small diversion bumps around certain floor drains, removal of floor drains, installation of a sump and pumps, and rerouting trench drain discharges to the tank farm area.

Along with the physical design of the system three environmental questions had to be answered. These questions were:

1. What analytical tests should be run to determine the water quality of the liquid contained in the spill collection tank?

To determine the water quality of the liquid contained in the spill collection tank, four analytical tests plus one aesthetic test are run. These tests are: COD (Chemical Oxygen Demand), pH, color, suspended solids, and aesthetics of water. In order to meet the Biochemical Oxygen Demand (BOD) restrictions on our discharges to the swale by our Corps of Engineers Discharge Permit Application, a series of BOD tests were run on all the chemicals stored in the tank farm area by the State Hygienic Lab in Iowa City. COD tests were similarly run on these materials in our own analytical lab. The results of these tests enabled us to develop a BOD and COD relationship for all these chemicals. Based on these tests it was determined that a COD equal to the BOD was the best value for approximating the BOD for everyday drainage into the basin.

2. Where can the contained liquid in the spill control tank be discharged—sanitary sewer or drainage swale?

Since we have the capability of discharging to either the drainage swale or sanitary sewer, the water quality criteria for these discharges had to be met. Our Corps of Engineers Discharge Permit Application submitted for this facility stated that discharges from the collection tank to the swale *will not* exceed specified BOD, suspended solids, color, and pH parameters as stated in this application. If the contained liquid surpasses these criteria, *it cannot and will not be discharged to the drainage swale.* Effluent discharged from the tank to the sanitary sewer also has to meet the criteria defined in the Iowa City Zoning Ordinance No. 2238—October, 1970, dealing with discharges into the municipal sewage system.

3. If a material (spill or polluted stormwater runoff) is pumped to the sewage treatment plant—how fast can it be safely pumped?

In order to answer this question we again called on our COD and BOD analyses. Using these results plus data supplied by the Iowa City Sewage Treatment Plant regarding the Plant's design, hydraulic and biological loadings and current loadings, we calculated the maximum quantity of water that we could safely discharge to the treatment plant at specific COD values without overloading the treatment plant.

Since hydraulic, BOD and Suspended Solids loadings at the Iowa City Treatment Plant are increasing as Iowa City grows, we will periodically update our calculations on the discharge rate from the collection tank to the sanitary sewer so as to not overload the treatment plant.

Thus, by answering these three environmental questions in the design of the spill collection system and constructing this system we have eliminated the possibility of an accidental spill being discharged to the sanitary sewer or drainage swale and causing serious environmental problems at our Iowa City Plant.

Summary

There are two types of spill control constructions: containment curbs and spill collection tanks. These facilities provide an adequate means of protecting from the adverse effects of a spill. A decision as to which facility to construct depends on many factors (operating procedures, railroad tracks, topography of land, etc.). Once the system has been designed there are certain environmental questions that one must answer to complete the design as we did at the Iowa City Plant. Once these questions have been answered and the facility has been designed and constructed, then a total spill protection system exists.

REFERENCES

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