DISPOSAL OF PROCESS WASTE WATER FROM POTATO PROCESSING PLANT OPERATIONS

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HISTORICAL BACKGROUND

American Potato Company began operations in Idaho Falls, Idaho in 1956 in the production of dehydrated potato granules. Operations were expanded and a new plant was built in Blackfoot, Idaho in 1958.

Within the period of a few years, about 1955-1960, no less than 18 potato processing plants were built in southeastern Idaho. This was the start of a new Agricultural Industry where little was known about the magnitude of the waste water problem and consequently little or no emphasis was planced on the the need for waste water disposal facilities. As a result all process waste water, high in both suspended and dissolved solids, went directly into the Snake River without any treatment whatsoever, The high chemical oxygen demand of the process waste water (as high as 5200 ppm C. O. D.) soon created a serious water pollution problem for many of the cities drawing their basic water supply from the Snake River downstream from the processing plants. Such was the case with the City of Twin Falls, which used water from the Milner Reservior as its source of domestic water. The fish were killed as the City water source became contaminated, and immediate action was required to eliminate the contamination.

The Idaho State Board of Health asked for the cooperation of Idaho potato processors in correcting the problem, and set as its initial goal a minimum of 50% reduction by each plant in the C. O. D. input load on the river within a one year period. This meant either lagooning of process water or primary treatment involving the use of a clarifier to remove essentially all settleable solids, including silt and organic material.

At that time also, an engineering committee was formed by the Association of Idaho Potato Processors in cooperation with the Idaho State Board of Health, the University of Idaho, and several leading sewage treatment equipment manufacturers tc determine the best method for the complete treatment of potato processing waste water effluent. This committee is presently evaluating several methods of treatment, and the problem is made very complex by the variety of potato processing operations, some involving lye peeling resulting in strongly alkaline wastes, some heavy with cooking oils from french frying processes, and all with high concentrations of dissolved organic solids, as well as chemicals having a high chemical oxygen demand. It is this high C. O. D. level that kills fish by deleting the oxygen supply in the water in oxidizing the organic load. By 1964 regulations governing the disposal of food processing waste water were more restrictive.

WASHINGTON DESIGN BASIS

Recognizing that water pollution was a major problem in operating a potato processing plant, American Potato Company started a feasibility study upon which a decision could be make regarding the location of a plant in Washington State. Based upon past experience in the Idaho situation the matter of waste water disposal was given primary consideration for resolution before design plans for the process could be developed and a site selection be made.

From this study a water usage system was developed to reduce process water consumption to a minimum, sufficient to sustain good operations and yet make it possible to contain all water on the plant property for use as irrigation water. The system developed takes water from a deep well on the plant site, uses it in processing operations, and disposes of the waste effluent by means of a spray irrigation system to irrigate about 160 acres of an on-site hay and grass crop.

PLANT PROCESS

Concept Developed on Basis of:

1. Reuse of water in plant
2. Water economy
3. Land disposal by crop irrigation
4. Disposal of settleable and screenable wastes as stock feed
5. Sufficient land in the plant site to adequately handle waste water.

WATER SYSTEM

1. Fresh water pumped from well at about 500 gpm.
2. Water usage is in three separate usage categories

   Sanitary - Potable water system

   1. Plant Quality Control Lab
   2. Drinking water fountains
   3. Toilets and Wash Basins
   4. Disposal of waste water from this system is through a sanitary septic tank and tile drain field system meeting U.S. Public Health Service and Washington State specifications.

B. Equipment Cooling - Potato washing and potato fluming system - Low C.O.D. water

1. Air compressor coolant, refrigeration compressor coolant, closed heat exchanger systems on process equipment after which the warm water is pumped under high pressure into a rotary drum potato washer for removing dirt from potatoes.

2. The wash water from the potato drum washer then is used to flume potatoes into process operations. The flume water is screened through a 20 mesh vibratory screener to remove potato pieces and other solids.

3. The water is piped to a small (50' x 50') outside settling basin for settling out of the silt. From the settling basin the water then flows in to a pump for spray irrigation. In the pump suction pit this settled wash water blends with the process waste water stream.

C. Process Water System - High C.O.D. water

1. Boiler for steam generation. The steam produced is used in the steam peeling and process cooking functions.

2. Various process cooling functions and plant cleanup, floor washing, a nd general sanitation, where water is in direct contact with peeled potatoes.

3. This water, after performing its first cooling and cleanup functions, is screened over a 40 mesh stationery screen.

4. After screening the water is pumped under pressure to the Secondary Washer, which removes the potato peel loosened in the Steamer.

5. The effluent from the washer containing suspended potato peel is then screened through a 40 mesh stationery screen. The solid waste and peel from the screening operation is used for cattle feed.

6. The screened water is then piped to the spray field pump pit where it is blended with the Line wash water from the settling pond, and then pumped to the spray field for disposal in a spray irrigation system. The water at this point contains from 900 to 5,5000 ppm. C.O.D., and has an average pH of 6.8 to 7.0

SPRAY FIELD OPERATION

1. Two pumps parallel, 700 gpm, 100 psig, Layne-Bowler pumps discharging into 8" steel, coated and wrapped, buried central line.

2. Irrigated Land -- 160 acres with buried main line running length of field. Valve boxes spaced at 60' apart with 50 valves in length of field.

3. Laterals are 3" aluminum pipe about 1500' to a lateral. Each line has 25 Rainbird #30 nozzles with a 1/4" orifice and a discharge rate of about 5 gpm. Four lines are in use simultaneously, thus 4 line @25 nozzles x 5 pgm = 500 pgm disposal rate. To increase the velocity throught the line and to prevent buildup of solids at the end of each header one larger nozzle is used at the end of each line. This nozzle has a 9/16" orifice. Each lateral waters a section 1500 feet long x 120 feet wide, or 180,000 sq. feet, and each lateral is moved once per 24 hours. Each lateral delivers 25 x 5 x 24 x 60= 180,000 gallons per day, or 1 gallon per sq. foot per day. This is the equivalent of about 1 -1/2 inches of precipitation per day. With evaporation losses, et all, during summer months the ground absorbs this water without difficulty. During winter months daily line moving is necessary to prevent over-saturation. The ground freezes in winter, and ice layers form. This melts gradually when hot spray water is applies to it again, thus there has been no great ice buildup and no runoff in spring. Water at the nozzle discharge is about 90°F and 80 psig pressure. The field is contoured at four foot contour intervals to aid in preventing runoff to the Rocky Coulee Wasteway in event of a line break.

An alfalfa and legume grass crop has been planted over the 160 acres to aid percolation of water into the ground. During the summer the crop has to be cut frequently since it grows rapidly with the nitrogen nutrients supplies in the waste spray. The most feasible method for removing this crop has been by wet cutting and chopping for silage. Because of our need for continuous usage of the field for disposal of waste water it is difficult to restrict water from segements of the field to permit cutting, drying, and baling of the hay, thus wet silage cutting best suits our needs.

Using the area for cattle grazing is not practicable since the animals compact the ground, lessening the ability of the soil to absorb water.

Generally speaking the spray system is odor free with only an occasional musty off-odor. If the water rate is too heavy and ponding occurs, odors will develop. Care is taken to prevent or reduce ponding. The system must be constantly checked to insure that the conventional aluminum irrigation lines have not become uncoupled, or that a riser pipe has not been blown out. In winter the telltale cloud of steam quickly discloses a trouble spot. Major difficulties with the system are associated with normal problems one could expect in operating an irrigation system in sub-freezing weather. Thermal expansion of aluminum lines from sub-freezing temperatures tend to pull apart or buckle with alternate cooling and heating.

In its second season of operation the system is working very well with no indication of soil plugging or loss in ability to absorb moisture. During the summer months with only 4 lines in operation, it takes just over 12 days to make a complete rotation of the field by means of the 50 valves on the main riser if a 24 hour set is used.

$$\frac{\text{50 Positioned Valves}}{\text{4 Line Valves in use simultaneously per day}} = \text{12 + days for 1 rotation}$$

This is not sufficient water to maintain the hay crop on the relatavely shallow soil, and make-up water from the Bureau of Reclamation system is used. Water need is more than doubled during summer months, and this additional water is supplied through normal irrigation sources, and not by increasing plant process water usage.

SUMMARY

At this time there are nine food plants in the Columbia Basin area processing potatoes, and disposal of process waste water continues to be of primary importance in such operations. The disposal of waste water through spray irrigation is a new concept in potato processing operation, and has been effective and reasonably trouble-free in our operation. There has been no noticeable plugging of the soil, and only continued usage will prove its ability to perform indefinitely. A spray irrigation waste disposal system, however, must be developed in the early plant design stage to provide sufficient acreage to handle the water volume, and to permit site selection in an area where spray irrigation can be conducted. This requires relatively level ground and deep soil.

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