General Motors de Mexico

Ramos Aripe Auto Complex (RAAC)

Water conservation and reuse program

Situation

General Motors de Mexico (GMM) Ramos Arizpe Automotive Complex (RAAC) is located in an arid region in the State of Coahuila, in northeast Mexico. The complex opened in 1980 in Ramos Arizpe (pop. 40,000) and by 2000, RAAC was manufacturing 590,000 engines, 171,000 transmissions, and assembling 222,000 passenger vehicles.

The only source of water in the area where the RAAC is located is a small, semi-confined aquifer that has a limited water storage capacity, and a relatively high salt content (0.2%). This does not allow direct well-water use for industrial or domestic purposes.

Since 1986, several things have occurred that changed RAAC's approach to water management. These include: 1) well-water levels have decreased; 2) fees that must be paid to the National Water Commission (CNA) for water rights have substantially increased; 3) CNA imposed limits on well water withdrawal; 4) limits on the concentrations of several parameters in the waste streams were issued; and 5) the demand for high quality water has increased, due to the expansion of the RAAC

Targets

The company's challenge included securing water for production processes without depleting the aquifer (which is also the local drinking water source), desalinating the well water supply and establishing a recycling and reuse process for the industrial and sanitary wastewater - all within the framework of an intensive water conservation program.

Actions

General Motors de Mexico RAAC has undertaken several programs to reduce water consumption, to suppress pollution due to industrial and sanitary wastewater discharge, and to reuse treated effluents.

Specifically these programs are:

- The development of a continuous intensive water conservation program that included leak detection and repair, and a review of the different water-treatment and water-reusing processes to detect water-saving opportunities

Reverse osmosis units of the brine-recovery system and the well water treatment system

- The implementation of an innovative system to recover most of the by-product brine from the reverse osmosis systems. This would increase the portion of reusable water from the system thereby reducing the amount of well-water withdrawn and extending aquifer life
- The construction of solar evaporation ponds to convert the final brine stream to solid salts for potential reuse. This avoids discharge of high levels of salt into a stream/creek system that is ultimately used for crop irrigation purposes
- The implementation of a complete physical-chemical and biological wastewater treatment facility to treat all industrial and sanitary wastewater
- The implementation of an innovative system to recover about 70% of the secondary effluent that results from the biological treatment of a pre-treated industrial wastewater
- The reuse of treated sanitary wastewater to irrigate RAAC gardens and sports-fields and to create a man-made lagoon. This area is the center of a recreational area for workers and families

Aeration tank of the biological treatment system for Industrial wastewater

Results

Treated water storage lagoon

Water conservation activities during the early days (1986-1997) show a steady reduction in the amount of water taken from the wells. Predictably, the subsequent years of conservation activities show fewer reductions as the "big-hits" came in the earlier period.

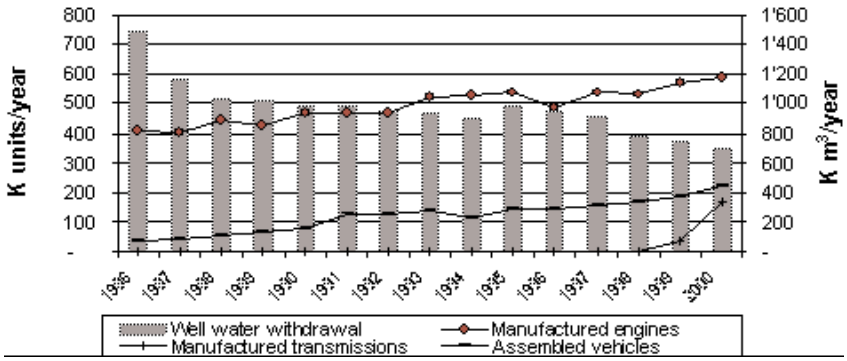
The Brine Recovery System (BRS) has been operating almost continuously for about 3 ½ years. It has produced water with low salt content that has been used mainly for the engine and transmission plants' water supply. It has also allowed RAAC to substantially reduce well-water withdrawal through an enhanced, more efficient use of well water by increasing the useable portion of water withdrawn from the well from 67% to 94%.

As a result of employing solar evaporation ponds, RAAC has been able to avoid the discharge of a salt-loaded stream to a creek whose water is used for crop irrigation purposes. The industrial and sanitary wastewater treatment has also reduced the pollution load of these streams, and prepared them for recovery through the BRS.

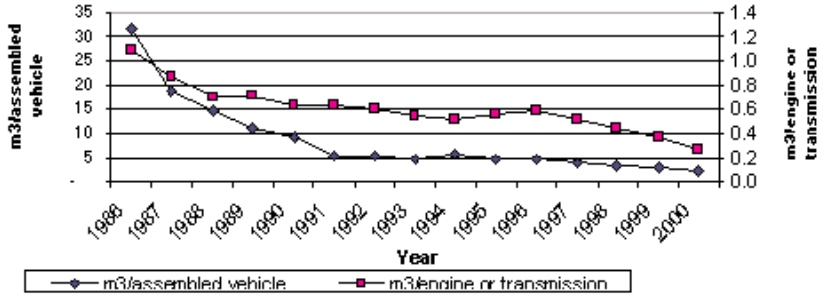
The integrative solutions have been a success for both the region and the production complex, which employs nearly 6,000 local residents and now produces annually some 590,000 engines and 222,000 passenger vehicles, mainly the Chevrolet Cavalier, Pontiac Sunfire and Chevy 3-, 4- and 5-door pickups.

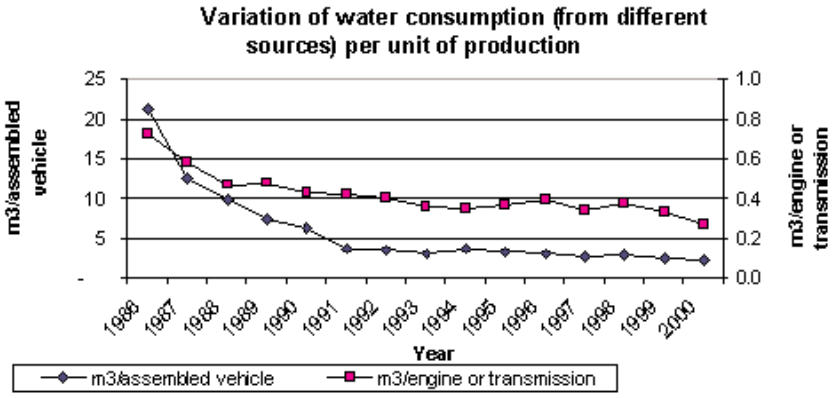
Through these efforts, GM Mexico has reduced annual well water withdrawal from 1,470,000 m3/year in 1986 to 700,000 m3/year in 2000, reducing the average amount of well water needed to produce a vehicle from 32 m3 to 2.2 m3. At the same time these reductions took place, production jumped - the company now manufactures about 7 times more cars, 50% more engines and brought on-line a new transmission plant that manufactured 171,000 units in the year 2000.

Variation of RAAC well water withdrawal and production



Variation of well water withdrawal per unit of production





The programs described in this document are an integral component of RAAC's Environmental Management System. Numerous awards have been presented to RAAC by both the Mexican government and ISO 14000 certification officials in recognition of the Complex's environmental accomplishments:

1. "Clean Industry" award (State of Coahuila, 1995)
2. "Energy Conservation Award" - Third place (Mexican Electricity Commission (1995)
3. "Environmental Excellence" award (State of Coahuila, 1996)
4. "Clean Industry" Certificate (SEMARNAP -Mexican EPA-, 1998),
5. ISO-14001 Certification (Det Norske Veritas, 1999)
6. "Clean Industry" Recertification (SEMARNAP, 2000)

Papers describing RAAC RO by-product brine and industrial secondary effluent treatment and recovery were presented at the 1998 and 1999 International Water Conferences (Pittsburgh, Pa., USA), and the Weftec-2000 Conference (Anaheim, Ca., USA).