ILLINOIS POLLUTION CONTROL BOARD
December 29, 1983

G. D. SEARLE & CO. AND SEARLE FOOD RESOURCES, INC. AND PARK FOREST SOUTH UTILITIES COMPANY,	)	
Petitioners,	)	
v.	)	PCB 83-73
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY,	)	
Respondent.	)	

MR. JEFFREY C. FORT AND MS. M. THERESE YASDICK, MARTIN, CRAIG, CHESTER AND SONNENSCHEIN, APPEARED FOR PETITIONERS;

MR. DAVID RIESER, ATTORNEY AT LAW, APPEARED FOR RESPONDENT.

OPINION AND ORDER OF THE BOARD (by D. Anderson):

This matter comes before the Board upon a petition and amended petition for variance filed June 3 and August 10, 1983 by G. D. Searle & Co., Searle Food Resources Inc. (Searle) and Park Forest South Utilities Company (PFSU). The amended petition requests a variance from 35 Ill. Adm. Code 307.102(a) as it relates to discharges to a public sewer system which may cause the treatment works effluent to cause violations of water quality standards for total dissolved solids (TDS), chloride and sulfate (35 Ill. Adm. Code 302.208).

On June 17, 1983 the Board received a timely written objection from Ms. Gisela Topolski, and directed that hearings be scheduled. The Board also received written objections from: Ms. Helen Nystrum, Mr. Lawrence Lawless, Mr. Richard Blievernicht, Mr. Liese Ricketts, Supervisor of Crete Township, and Mr. Robert Gaines. On August 26, 1983 Ms. Topolski withdrew her objection.

On July 5, 1983 the Illinois Environmental Protection Agency (Agency) recommended that the variance be denied for lack of information. On September 16, 1983 the Agency filed a first amended recommendation which indicated that some of the needed information had been supplied; however, the Agency could not determine whether arbitrary or unreasonable hardship existed and declined to make a recommendation as to whether to grant or deny the variance. The Agency did, however, recommend conditions should the Board determine to grant a variance. On December 8, 1983 the Agency filed a brief which recommended a grant of the variance with conditions. On September 27, 1983 Searle filed a response to

the recommendation. A public hearing was held on November 2, 1983 in Park Forest South. Members of the public attended and commented.

On November 30, 1983 the Board received a letter from the Agency requesting incorporation into the record of a letter to the Agency from Mr. E. E. (Bud) Sweet dated November 14, 1983. On December 23, 1983 the Board received a letter from the petitioners opposing the incorporation. The Board hereby incorporates both Mr. Sweet's and the Petitioner's letters into the record as public comments.

On December 19, 1983 Petitioners filed a motion to correct line 16 on page 30 of the transcript to read $8,400,000 instead of $8,400 per year. The motion is granted.

On December 28, 1983 petitioners filed a motion for leave to file their reply brief, which had been filed on December 27. The motion is granted.

This variance concerns a plant owned by Searle in Park Forest South, Will County. The plant manufactures aspartame, a low calorie sweetener recently approved by the Food and Drug Administration (R. 23). The operation is referred to as a pilot plant. It will eventually produce 130 metric tons per month. It will have over 200 full time employees and an annual payroll in excess of $6 million dollars per year (R. 22) Searle purchased the plant, which included some equipment which could be adapted to aspartame production (R. 24).

Development of the plant is proceeding in four phases or "trains" (Amended Pet., p. 3, R. 24). Train IV will be complete "by the end of the year", apparently meaning 1984 (R. 34).

Aspartame production involves bonding two amino acids together and purifying the adduct. This involves the use of sulfuric acid, hydrochloric acid and acetic anhydride, with neutralization by caustic soda. This produces a high TDS process wastestream. In addition, solvent and methanol recovery operations produce a high TDS bottom wastestream (R. 54). Other sources include boiler blowdown and the regeneration backwash from xeolite water softening (R. 38, 42, 54, 62, 112).

The primary constituents of the TDS are chloride and sulfate (R. 59). After completion of the expansion, Searle would produce a discharge described in the following table

based on a flow of 0.916 million liters per day (0.242 million gallons per day (MGD))(R. 51, 55):

	Average kg/day	Maximum (98%) kg/day
Chloride	1224	1483
Sulfate	785	1084
TDS	7650	11,010

Searle presently has some of its high TDS waste hauled off-site for disposal. This amounts to over 25,500 gallons per day at a cost of nearly $2 million (R. 29, 39).

Searle pretreats its waste prior to discharge to the Park Forest South sewer: a solvent recovery column can be used to reduce the organic loading; and, a 1.7 million liter holding basin mixes and equalizes the discharge flow (R. 25, 35, 44).

The sewage is received at a treatment plant owned by Respondent PFSU, a privately owned company which provides water and sewer services to the Village of Park Forest South (R. 50). The plant includes activated sludge with tertiary treatment via granular media gravity filters. It discharges pursuant to NPDES Permit No. IL 0024473 to Deer Creek (R. 51).

The treatment plant has a design capacity of 2.17 MGD and an average dry weather flow of 0.9 MGD (3.4 million liters per day), exclusive of any flow from Searle (R. 50). Taking into account the variability of both the Searle and background levels, the following discharge is predicted as a maximum concentration to be exceeded less than 2% of the time, and the mass discharge based on a flow of 4.32 million liters per day (1.142 MGD) (R. 50, 57):

	mg/l	kg/day
Chloride	492	2130
Sulfate	574	2480
TDS	3140	13,600

TDS may have an adverse impact on activated sludge processes at chloride levels of 18,000 to 20,000 mg/l resulting in an increase in suspended solids and reduction in organic material removal. However, no impact is expected at levels to be produced by the Searle discharge (R. 59, 63, Ex. 4).

The effluent discharges to Deer Creek (R. 51). Above the plant Deer Creek is an intermittent stream; below it is perennial (R. 71). It meanders east and north through suburban areas; at the Lincolnshire Golf Course it is dammed to form a shallow, 18-acre lake, called Deer Lake (R. 71).

About 14 miles from the discharge Deer Creek joins Thorn Creek, a tributary of the Little Calumet River (R. 72).

Deer Creek is a low gradient stream, meaning it drops only a small distance for each mile of stream length (R. 103). It has been channelized for short distances near East Chicago Heights (R. 72). The bottom is covered with a fine grain material resulting from erosion. This has reduced the habitat availability (R. 107). The PFSU discharge provides a constant flow providing relief for aquatic life from hot, dry conditions with low oxygen (R. 74, 77). At one time there were several sewage discharges, but now PFSU is the only licensed discharger (R. 72, 95).

Above the treatment plant background levels of TDS have approached or exceeded the 1000 mg/l standard; indeed, levels as high as 41,000 mg/l have been found, based on conductivity (R. 58, 77, 86). High TDS levels are attributed in part to elevated TDS levels in well water used for the public water supply (R. 79). PFSU supplies water softened by xeolite to Park Forest South (R. 112).

Presently mean TDS near the PFSU plant is 3957 mg/l. The plant discharge is 80 to 90% of the flow at this point. TDS falls to 1200 mg/l at the outfall of Deer Lake (R. 77, 86, Ex. 7).

Deer Creek is classified as semi-polluted to polluted, based on Agency criteria involving counts of benthic macro-invertebrates (R. 93, Ex. 7). The bottom deposits noted above would be sufficient to result in this classification (R. 109). Consultants employed by petitioners have conducted stream studies which confirm this classification (R. 73, 96). These studies are continuing in preparation for a site-specific rulemaking (R. 75). Species identified are tolerant to high TDS levels (R. 82, 96).

The following regulations are involved in this variance request:

35 Ill. Adm. Code	Summary
302.208	General use water quality standard of 500 mg/l chloride
302.208	General use water quality standard of 500 mg/l sulfate
302.208	General use water quality standard of 1000 mg/l TDS

35 Ill. Adm. Code	Summary
304.105	Prohibition of effluent discharges which cause or contribute to a violation of water quality standards
307.102(a)	Prohibition of discharges to public sewers which cause the effluent discharge from the treatment works to violate water quality standards.

Total dissolved solids includes everything which is dissolved, as opposed to suspended, in water and which remains on evaporation. It is closely related to the salinity or hardness of water. It is an aggregate measure of many possible contaminants, including toxic materials. However, the TDS standard is set at a level hundreds to millions of times higher than the standards for individual toxic contaminants, so that it is extremely unlikely that the TDS standard could be violated by a toxic discharge without a violation of a standard for a toxic contaminant. In practice, TDS usually consists mostly of chloride and sulfate, which are normally ingested in the human diet, but which can cause problems to aquatic life if present in high concentrations (R. 79).

The Board had an effluent standard of 3500 mg/l TDS. This was repealed after the Board recognized that the treatment processes for TDS are very expensive, consume large amounts of energy and produce concentrated brines which must still be disposed of (R76-21, 43 PCB 367, 398, September 24, 1981). Regulation of TDS discharges was left to application of the water quality standards for TDS, chloride and sulfate.

The water quality standards were set in R71-14 (3 PCB 755, March 7, 1972). They were set in part by reference to then-current studies on the toxicity of the contaminants to aquatic life. More recent studies done in Illinois have suggested that the chloride standard should be raised to around 800 mg/l, the sulfate standard to around 1000 mg/l and the TDS standard to around 1400 mg/l based on one-tenth of the 96-hour median tolerance level (R. 81, 102, Ex. 6).

In R79-6 the Agency proposed to divide the State into river basins and propose water quality standards applicable within each basin. The Board dismissed R79-6, but accepted the principle of regulation by basins. The first basin proposal, concerning the Sangamon River, has been proposed in R83-20. Eventually there will be a proposal for the Lake Michigan/Des Plaines basin involved in this variance. This could involve modification of the TDS related water quality standards for Deer Creek.

The Searle discharge will cause the PFSU plant effluent to exceed the existing TDS water quality standard, and to come uncomfortably close to the chloride and sulfate standards. Since the PFSU discharge comprises 80 to 90% of the flow in the stream, it will cause violations of water quality standards. Searle has proposed a site-specific modification of the regulations to allow this discharge, which the Board has dismissed (R83-14). Searle has committed itself to either pursue a site specific rule or to come into compliance. In the interim, Searle needs a variance to expand the plant and discontinue in part the present practice of hauling high TDS wastewater away from the plant. Searle has taken steps to reduce the TDS production, and has a program which may result in further reductions.

Searle has completed the following steps to reduce its TDS production:

1. Rinse time of water softeners has been reduced from four hours to one hour.

2. Steam condensate return system has been installed to reduce the use of soft water.

3. Piping has been installed to utilize soft water for boiler feed and for cleaning of some equipment.

4. Superheaters on the methanol and solvent recovery columns, which used soft water, have been eliminated.

5. Cooled glycol has been substituted for some once-through softened cooling water.

6. Some cooling utilizing soft water has been eliminated.

7. New boiler blowdown control system has been installed.

Most of the above existing steps involve reducing the consumption of softened water, since the backflushing with sodium chloride appears to be an important contributor to the TDS load (R. 27, 42).

Searle has proposed a continuing program to reduce the TDS production further. One possibility is to utilize the well water directly for aspartame production, without softening. Another is replacement of the xeolite softening with reverse osmosis to eliminate the addition of TDS during the regeneration backflushing (R. 28, 32). Searle has committed itself to completion of these studies by July, 1985 (R. 28, Reply Brief).

Searle is currently avoiding water quality violations by hauling some of its high TDS wastewater for off-site disposal. Disposal of 25,500 gallons per day at $0.115 per gallon costs about $1,960,000 per year. Costs are expected to rise to $0.13 per gallon in 1984. With completion of the plant, about 178,000 gallons per day would require disposal off-site without the variance, costing about $8,400,000. With the variance requested, only 18,000 gallons per day would require off-site disposal, costing only about $850,000 per year (R. 30). This difference of $7,650,000 per year is the hardship complained of.

The stream studies conducted by Dames and Moore for the petitioners indicate that the combined concentration of chloride and sulfate could exceed 1800 mg/l, and TDS levels 5130 mg/l, without causing undue stress to aquatic communities (R. 82, Ex. 7). The levels of TDS proposed would not limit improvement in stream conditions should certain other limiting factors be removed (R. 96).

During a hot, dry summer Deer Lake could act as an evaporating basin resulting in elevated TDS levels. Dames and Moore predict a maximum TDS concentration of 3800 mg/l during a 30-day period without rain in July (R. 83, Ex. 8). Considering that the lake habitat is severely stressed due to the practice of draining it several times per year by the golf course, these TDS levels should have no impact (R. 84).

Another concern is the use of water from Deer Creek for irrigation. Dames and Moore walked the stream and saw no indications of permanent irrigation systems (R. 72, 87, 89). However, Mr. Simon DeBoer and Mr. Fred Schubert testified that they used the creek water for irrigation (R. 143, 155, 160).

One problem with irrigation with high TDS water is that it can cause a decrease in permeability of clays. The tendency of high TDS water to do this depends on the sodium adsorption rate (SAR) and the type of clay. According to Dames and Moore, the SAR for the wastewater is 12.7, which is below the critical value of 20 for nonexpanding clayey soils, such as the illites which border the stream. The sodium content of the wastewater is therefore not expected to have any deleterious effect (R. 85, 98, 102).

Another problem concerns contamination of shallow wells near Deer Creek with high TDS water, and the possibility that Deer Creek serves as a recharge source for local aquifers. Dames and Moore did not identify any shallow wells adjacent to the creek during their stream walk (R. 72, 87, 89, 91, 96, 109). They defined "shallow wells" as wells less than 20 feet deep, probably hand-dug wells at older residences (R. 96, 160, 170). There are a number of wells up to and over

100 feet deep (R. 97, 110, 160). The area contains sand formations which may conduct water to the deeper limestone aquifer. On the other hand, it is possible that impermeable layers between the surface and this depth preclude the possibility that the stream is recharging the deeper aquifer (R. 172). The Agency has recommended that the variance be conditioned on studies to be performed by Searle on whether the discharge will impact TDS levels in water used for drinking and irrigation.

The Board finds that it would impose arbitrary or unreasonable hardship to require Searle to continue hauling its waste off-site for disposal, pending completion of studies which will be made conditions of this variance. The Board also notes Searle's stated intent to timely pursue a site-specific rule change, or, alternatively, to comply (R. 33). The Board will therefore grant the variance with conditions.

Petitioners originally requested a variance from Section 307.102(a). The Agency recommended a variance from the water quality standards also, and Petitioners agreed to this. However, the Board will instead grant Searle a variance from Section 307.102(a) only, and grant Park Forest South a variance from Section 304.105 only. These Sections prohibit discharges to the sewers and from the sewage treatment plant, respectively, which cause violations of water quality standards in the receiving stream. The Board will set water quality-based effluent standards as conditions of the variances.

The conditions of the Board's Order are similar to conditions recommended by the Agency in its Brief, with certain exceptions. The Board has split the Order to provide separate variances and conditions for Searle and PFSU. The discharge and effluent limiting conditions have been made immediately applicable, thereby avoiding a variance without limitations through completion of Train IV. The studies on the impact on groundwater and irrigation uses will be required by the end of 1985 in order to assure that this information is available in time for a site-specific rulemaking.

The Board notes that Searle and PFSU have stipulated that PFSU provides xeolite water softening for the Park Forest South public water supply. The discharge from recharging of this is probably very high in TDS. The Board notes also that xeolite softening contributes to high sodium levels in drinking water supplies. Elevated sodium levels have been linked to a number of health problems. There are processes such as lime softening which avoid high sodium levels, and may result in lower TDS discharges. The Board therefore will require PFSU to report to the Agency as to where its softener regeneration waste is discharged. In the

event it is being discharged to Deer Creek, PFSU will be required to undertake studies as to how to reduce or eliminate any TDS discharges from water softening.

This Opinion constitutes the Board's findings of fact and conclusions of law in this matter.

ORDER

1) Petitioners G. D. Searle & Co. and Searle Food Resources, Inc. are granted a variance from 35 Ill. Adm. Code 307.102(a) as it applies to the water quality standards for total dissolved solids, chloride and sulfate of 35 Ill. Adm. Code 302.208, subject to the following conditions:

   a) This variance applies only to discharges to publicly regulated sewers from Petitioners' aspartame production facility in Park Forest South.

   b) This variance will expire on December 29, 1988, or 35 days after a site specific rule applicable to the subject discharges is filed with the Secretary of State, whichever occurs first.

   c) The discharge shall be subject to the following interim discharge limitations, where the terms "monthly average" and "daily composite" shall be as defined in 35 Ill. Adm. Code 304.104:

	Daily Composite (kg/day)	Monthly Average (kg/day)
Chloride	1500	---
Sulfate	1100	---
Total dissolved solids	11,100	7700

   d) Petitioners shall monitor their discharge and the stream for the following: total dissolved solids, sulfate, chloride, sodium and flow. The monitoring frequency shall be weekly at locations downstream of Park Forest South Utility Company's outfall and daily at Searle's discharge to the sewer.

e) On or before July 31, 1985 Petitioners shall complete a study of the following alternatives:

i) the utilization of the plant's raw water supply in lieu of deionized water for various process water usages and the installation of a reverse osmosis unit to reduce or eliminate the deionization and water softening operations;

ii) physical-chemical desalination processes, such as reverse osmosis, electrodialysis, freeze crystallization, multistage flash distillation, multiple effect or vertical tube evaporation, including associated pretreatment facilities;

iii) utilization of lime or ammonia instead of caustic for neutralization of acids and the use of the resulting solutions as soil conditioners in landfill operations; or

iv) some combination of the above processes or alternatives.

f) On or before August 31, 1985 Searle shall send to the Illinois Environmental Protection Agency a report summarizing the results of the investigations of paragraph (1)(e) of this Order.

g) On or before March 1, 1984 Petitioners shall submit to the Illinois Environmental Protection Agency for its approval a plan of study for demonstrating the impacts of the increased total dissolved solids levels on drinking water and irrigation in the area for Deer Creek. Petitioners shall perform the study outlined in the approved plan and submit the final report to the Agency on or before January 1, 1986.

h) Petitioners shall complete the following compliance plan even if no final decision in the rule change petition has been made:

i) by January 31, 1985 establish process design loadings and develop process waste stream segregation;

ii) by July 30, 1985 complete conceptual design;

iii) by January 31, 1986 complete installation of pilot plant;

iv) by October 31, 1986 complete detailed technical and economic evaluation, establish process design criteria and select treatment/control system.

i) Within 45 days of the date of this Order, Petitioners G. D. Searle & Co. and Searle Food Resources, Inc. shall execute and forward to the Illinois Environmental Protection Agency, Variance Section, 2200 Churchill Road, Springfield, Illinois 62706, a Certificate of Acceptance and Agreement to be bound to all terms and conditions of this variance. This 45 day period shall be held in abeyance for any period this matter is being appealed. The form of the Certificate shall be as follows:

CERTIFICATION

We, _____, having read and fully understanding the Order in PCB 83-73 hereby accept that Order and agree to be bound by all of its terms and conditions.

SIGNED _____

TITLE _____

DATE _____

2) Petitioner Park Forest South Utilities Company is granted a variance from 35 Ill. Adm. Code 304.105 as it applies to the water quality standards for total dissolved solids, chloride and sulfate of 35 Ill. Adm. Code 302.208, subject to the following conditions:

a) This variance will apply only to effluent discharges to Deer Creek from the sewage treatment plant receiving the discharges described in paragraph (1)(a) of this Order.

b) This variance shall expire at the same time as in paragraph (1)(b) of this Order.

c) The discharge shall be subject to the following water quality-based interim effluent standards, where the terms "monthly average" and "daily composite" shall be as defined in 35 Ill. Adm. Code 304.104:

	Daily Composite (mg/l)	Monthly Average (mg/l)
Chloride	500	---
Sulfate	600	---
Total dissolved solids	3150	2500

d) Petitioner shall monitor its effluent daily for the parameters in paragraph (2)(c), as required in its NPDES permit.

e) The Illinois Environmental Protection Agency shall modify NPDES Permit No. IL 0024473 consistent with this variance.

f) On or before June 1, 1984 Park Forest South Utilities Company shall report to the Illinois Environmental Protection Agency as to where its water softening waste is discharged, and as to the quantities of total dissolved solids, chloride and sulfate discharged.

g) If Park Forest South Utilities Company is discharging total dissolved solids from water softening to Deer Creek, on or before January 1, 1986 it shall report to the Illinois Environmental Protection Agency as to how to reduce or eliminate any TDS discharges to Deer Creek.

h) Within 45 days of the date of this Order, Petitioner Park Forest South Utilities Company shall execute and forward to the Illinois Environmental Protection Agency, Variance Section, 2200 Churchill Road, Springfield, Illinois 62706, a Certificate of Acceptance and Agreement to be bound to all terms and conditions of this variance. This 45 day period shall be held in abeyance for any period

this matter is being appealed. The form of the Certificate shall be as follows:

CERTIFICATION

I, (We,) _____, having read and fully understanding the Order in PCB 83-73 hereby accept that Order and agree to be bound by all of its terms and conditions.

SIGNED _____

TITLE _____

DATE _____

IT IS SO ORDERED.

Chairman J. D. Dumelle and Board Member J. Anderson concurred.

Board Member B. Forcade dissented.

I, Christan L. Moffett, Clerk of the Illinois Pollution Control Board, hereby certify that the above Opinion and Order were adopted on the 29th day of December, 1983 by a vote of 6-1.

Christan L. Moffett
Christan L. Moffett, Clerk
Illinois Pollution Control Board