SHOLTES & KOOGLER, ENVIRONMENTAL CONSULTANTS
1213 N.W. 6th Street Gainesville, Florida 32601 (904) 377-5822

SKEC 230-84-01

April 3, 1985

Mr. C. H. Fancy
Deputy Chief, Bureau of Air Quality Management
Florida Department of Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32301

DER
APR 4 1985
BAQM

Subject: Royster company
Polk County, Florida
Application for Construction Permit
to Increase Production Capacity of
an Existing Sulfuric Acid Plant

Dear Mr. Fancy:

Enclosed are three copies of the Air Quality Review and Best Available Control Technology Recommendations, Volume I, and one copy of Volume II which includes the modeling results, for Royster Company.

These documents are being submitted to supplement information previously submitted to your office by Royster Company.

If you have any questions or comments concerning the enclosed materials, please don't hesitate to contact me.

Very truly yours,

SHOLTES & KOOGLER,
ENVIRONMENTAL CONSULTANTS

John B. Koogler, Ph.D., P.E.

JBK:ssc
Enclosures

AIR QUALITY REVIEW
AND
BEST AVAILABLE CONTROL TECHNOLOGY
RECOMMENDATIONS

ROYSTER COMPANY
VOLUME I

APRIL 1985

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Mr. C. H. Fancy
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Florida Department of Environmental Regulation
2600 Blair Stone Road
Tallahassee, Florida 32301

Subject: Royster Company
Polk County, Florida
Application for Construction Permit
to Increase Production Capacity of
an Existing Sulfuric Acid Plant

Dear Mr. Fancy:

The enclosed information is submitted to satisfy the requirements for an Air Quality Review necessitated by the proposed increase in the sulfuric acid production rate of an existing sulfuric acid plant at the Royster Company in Polk County, Florida. The proposed action will result in a 300 tons per day increase in the sulfuric acid production capacity of the facility; from 1400 tons per day to 1700 tons per day of 100 percent sulfuric acid.

300 TPD increase
1400 → 1700 TPD ACID

**PROPOSED AND EXISTING OPERATING PARAMETERS**

Royster has submitted to your office several documents defining construction and operating permits that have been issued for the subject sulfuric acid plant, the conditions imposed by these permits, actual plant production rates and actual plant sulfur dioxide and sulfuric acid mist emission rates. These data and information are summarized in Table 1. The information presented in Table 1 was used to calculate actual annual sulfur dioxide and sulfuric acid mist emission rates under existing operating conditions; that is, operating conditions that existed between December 1978 and the present. The data presented in Table 1 were also used with an appropriate emission factor to calculate the annual nitrogen oxides emission rate under existing operating conditions.

The proposed production rate, both daily and annual, the proposed sulfur dioxide and sulfuric acid mist emission rates (based on federal

New Source Performance Standards), stack parameters and annual air pollutant emission rates for proposed operating conditions are summarized in Table 2. The proposed maximum daily production rate for the plant will be 1700 tons of 100 percent sulfuric acid per day and the annual production rate, based on 350 days per year continuous operation, will be 595,000 tons per year of 100 percent sulfuric acid. The proposed sulfur dioxide and sulfuric acid mist emission limits are 4.0 pounds per ton and 0.15 pounds per ton, respectively.

The annual pollutant emission rate increases, based on the proposed increase in sulfuric acid production, are summarized in Table 3. The emission rate increases were determined to be 386 tons per year for sulfur dioxide, 30.9 tons per year for sulfuric acid mist and 11.4 tons per year for nitrogen oxides. The emission rate increases which have been determined to be significant for these pollutants (17-2.500, FAC) are 40 tons per year for sulfur dioxide, 7 tons per year for sulfuric acid mist and 40 tons per year for nitrogen oxides. The emission rate of carbon monoxide from the sulfuric acid plant may increase slightly (less than one ton per year) but the emission rate increase will be well below the 100 tons per year de minimus emission rate increase for this pollutant. From these data it is apparent that the proposed action will result in significant emission rate increases for sulfur dioxide and sulfuric acid mist; thus requiring an Air Quality Review and a Best Available Control Technology (BACT) determination for these pollutants.

**AIR QUALITY REVIEW**

The air quality review for sulfur dioxide and sulfuric acid mist was conducted in three steps. First the CRSTER air quality model was run with emission data from the Royster sulfuric acid plant representing both existing operating conditions ( 1400 tons per day of 100 percent sulfuric acid) and proposed operating conditions (1700 tons per day of 100 percent sulfuric acid). From these model runs, the distance to the point of maximum impact was determined and the impact of the net increase in sulfuric acid mist emissions was estimated.

The second and third steps of the air quality review were conducted with the ISC-ST air quality model with a calm processor. The calm processor functions to remove the impacts resulting from hours with reported calm wind speeds in a manner consistent with EPA guidelines. The ISC-ST model was first run with sulfur dioxide emissions from the Royster sulfuric acid plant only; the emissions for plant operation at 1400 tons per day being input as a negative emissions and emissions at the proposed 1700 tons per day operating conditions being input as positive emissions. This convention results in the ISC-ST model calculating the impact of the net sulfur dioxide emission rate increase resulting from the proposed production rate increase.

The third step of the air quality review was a set of runs with the ISC-ST air quality model, again using the calm processor. For these model runs, sulfur dioxide emission data from all significant sources within 50 kilometers of the Royster site were input into the model. The purpose of this set of model runs was to demonstrate that sulfur dioxide impacts, resulting from all sources within the area where Royster has a significant impact, are below ambient air quality standards.

The meteorological data used for all air quality modeling were data from Orlando, Florida representing the period 1974-1978. The Orlando meteorological data were used since they were determined to be more representative of a source in inland west-central Florida than meteorological data from Tampa; a coastal site.

The Royster source data input to the air quality model were derived from the information presented in Tables 1 and 2. The model input data for Royster under existing operating conditions (1400 tons per day) and proposed operating conditions (1700 tons per day) are summarized in Table 4.

CRSTER Modeling

The output of the CRSTER air quality model is attached as Appendix A. From these data it was determined that the maximum impact of emissions from the Royster sulfuric acid plant will generally be within one kilometer of the plant for the 3-hour and 24-hour time periods and within two kilometers for the annual period. From these same data it was determined that the maximum sulfuric acid mist impact under existing operating conditions will be 0.27 micrograms per cubic meter, 24-hour average, and under proposed operating conditions, 0.75 micrograms per cubic meter, 24-hour average. The net increase in the ground-level impact of sulfuric acid mist emissions for the 24-hour period was estimated to be 0.48 micrograms per cubic meter. This compares with a suggested de minimus impact of 1.0 micrograms per cubic meter, 24-hour average, (Health Impacts, Emissions, and Emission Factors for Non-Criteria Pollutants Subject to De Minimus Guidelines and Emitted from Stationary Conventional Combustion Processes, U.S. EPA, June 1980); an impact that even total sulfuric acid mist emissions with the plant operating at 1700 tons per day does not create.

Since the impact of the net increase in sulfuric acid mist emissions (and the impact of total sulfuric acid mist emissions) is below the suggested de minimus impact level, further air quality modeling and impact analyses are not required for this pollutant. The results of the air quality modeling for sulfuric acid mist are summarized in Table 5.

ISC-ST Modeling

The ISC-ST model runs used to evaluate the impact on air quality of the increase in sulfur dioxide emissions from the Royster sulfuric acid plant are attached as Appendix B. The results of these model runs are summarized in Table 6.

These data show that the increase in sulfur dioxide emissions (resulting from a production rate increase from 1400 to 1700 tons per day) will result in a maximum annual impact on air quality of 0.3 micrograms per cubic meter, a maximum 24-hour impact of 3.9 micrograms per cubic meter and a maximum 3-hour impact of 17.6 micrograms per cubic meter. These impacts compare with significant impact levels of 1.0, 5.0 and 25.0 micrograms per cubic meter for the annual, 24-hour and 3-hour periods, respectively.

Based on the results of these model runs, it can be concluded that the production rate increase proposed by Royster will not result in a significant impact on ambient air quality. As a result of this, further air quality modeling to evaluate PSD increments consumption is not required.

A second comparison that can be made with data summarized in Table 6 is a comparison between the maximum 24-hour sulfur dioxide impact and the de minimus impact for sulfur dioxide. The de minimus impact for sulfur dioxide is defined as 13 micrograms per cubic meter, 24-hour average (17-2.500 FAC). This compares with a calculated 3.9 microgram per cubic meter impact resulting from the production rate increase proposed by Royster. The fact that the calculated emission rate increase is less than the de minimus impact for sulfur dioxide means that air quality monitoring for sulfur dioxide is not required for the proposed project.

The final set of ISC-ST model runs, those used to demonstrate compliance with air quality standards, are attached as Appendix C. The input for these model runs included the actual sulfur dioxide emission rates from 80 sources that could have a significant impact at the Royster site. The sources included in the emission inventory are listed in Table 7. Again, the meteorological data used for the modeling are Orlando data representing the period 1974-1978.

Receptors were located using a polar coordinate system centered at Royster. Receptors were located on 10 concentric circles at distances ranging from 0.5 to 10.0 kilometers from Royster and were spaced radially at 20 degree intervals. The area covered by the receptor grid is shown in Figure 1.

The results of the air quality modeling to demonstrate compliance with ambient air quality standards are summarized in Table 8. The results of this modeling show a maximum annual average impact of the two Royster sources (the sulfuric acid plant and a DAP plant) of 1.9 micrograms per cubic meter and a maximum annual impact of all sources of 42 micrograms per cubic meter. These impacts compare with an annual ambient air quality standard for sulfur dioxide of 60 micrograms per cubic meter.

(It should be noted that Royster also has a 132 million BTU per hour auxiliary boiler fired with number 6 fuel oil. Since this boiler is not operated concurrently with the sulfuric acid plant, and since only the sulfuric acid plant is the sibject of this application, the boiler has been excluded from the air quality review.)

The maximum 3-hour impact of the Royster sources was determined to be 123 micrograms per cubic meter and the maximum 3-hour impact of all sources was determined to be 757 micrograms per cubic meter; compared with a 3-hour ambient air quality standard for sulfur dioxide of 1300 micrograms per cubic meter. The maximum 24-hour impact of Royster sources was calculated to be 20 micrograms per cubic meter compared with a 24-hour air quality standard of 260 micrograms per cubic meter and a maximum 24-hour impact of all sources of 221 micrograms per cubic meter. The areas where the high sulfur dioxide impacts occur for the various time periods are designated in Figure 2.

The air quality modeling presented in Appendix C and summarized in Table 8 also shows that the distance to the boundary of the area of influence (the area in which a source has a significant impact on air quality) for Royster for the 3-hour and annual periods is less than 10.0 kilometers; the distance to the outermost receptors. The air quality modeling for these two periods of time demonstrates, therefore, that the sulfur dioxide air quality standards for the 3-hour and annual periods are achieved in all areas where Royster has a significant impact.

For the 24-hour period, an extrapolation of data presented in Appendix C and summarized in Table 8 indicates that the area of influence of Royster sulfur dioxide emissions for the 24-hour period extends to approximately 13 kilometers; a distance slightly beyond the 10 kilometer receptor boundary. The air quality modeling summarized in Table 8 for the 24-hour period shows compliance with the 24-hour sulfur dioxide air quality standard within 10 kilometers of Royster. From a review of the source distribution between 10 and 13 kilometers from Royster (Figure 1) and a review of past air quality modeling conducted for many of the sources just beyond 10 kilometers from Royster, it is apparent that the sulfur dioxide air quality standard within the 24-hour area of influence of Royster will also be complied with. Previous air quality modeling for permitting purposes has been conducted for Lakeland Utilities (Source 12, Figure 1), IMC/New Wales (Source 14, Figure 1), AMAX Big Four Mine (Source 5, Figure 1), Agrico South Pierce (Source 4, Figure 1) and USS Agri-Chemicals Ft. Meade (Source 3, Figure 1). All of this modeling demonstrated compliance with all sulfur dioxide air quality standards within the area of influence of these sources.

Air Quality Review Summary

The air quality review for the sulfuric acid plant production rate increase proposed by Royster has demonstrated:

1. The impact of the increased sulfur dioxide emissions will be less than de minimus (13 micrograms per cubic meter, 24-hour average) therefore air quality monitoring will not be required,

2. The impact of the increased sulfur dioxide emissions will be less than significant (1.0 micrograms per cubic meter, annual average; 5.0 micrograms per cubic meter, 24-hour average; and 25.0 micrograms per cubic meter, 3-hour average), thus a PSD increment analysis is not required,

3. The sulfur dioxide air quality standards for all time periods are complied with within the area of influence of Royster, and

4. The impact of the increased sulfuric acid mist emissions will be less than the suggested de minimus impact for sulfuric acid mist (1.0 microgram per cubic meter, 24-hour average).

**BEST AVAILABLE CONTROL TECHNOLOGY**

Best Available Control Technology (BACT) is required to control air pollutants emitted from major sources or from major modifications to existing air pollution sources if the increase in the emission rate of the air pollutant exceeds de minimum emission rate increases defined in state (17-2.500, FAC) and federal PSD regulations. The de minimum emission rates for pollutants that are potentially emitted from sulfur acid plants are: sulfur dioxide - 40 tons per year; sulfuric acid - 7 tons per year; and, nitrogen oxides - 40 tons per year.

The proposed increase in sulfuric acid plant production capacity at Royster (from 1,400 tons per day to 1,700 tons per day) will result in increases in the sulfur dioxide and sulfuric acid mist emission rates that exceed the de minimum emission rate increases for these two pollutants. Sulfur dioxide emissions will increase by 386 tons per year and sulfuric acid mist emissions will increase by 31 tons per year (see Table 3). Thus, BACT will be required for these pollutants.

EPA has established new source performance standards for sulfuric acid plants. These standards limit sulfur dioxide emissions to 4.0 pounds of sulfur dioxide and 0.15 pounds of sulfuric acid mist per ton of 100 percent sulfuric acid produced. EPA reviewed these standards in 1979 and concluded that the new source performance standards for the sulfuric acid plants should not be made more stringent. (Drabkin, M. and Brooks, J.J., A Review of Standards of Performance for New Stationary Sources - Sulfuric Acid Plants, U.S. EPA, EPA-450/3-79-003, January 1979.)

The sulfur dioxide emissions at Royster are, and will continue to be controlled by double absorption and acid mist emissions are, and will continue to be controlled with high efficiency mist eliminators. In the following sections, the alternative control technologies for both sulfur dioxide and sulfuric acid mist are discussed.

Sulfur Dioxide

In the review performed by EPA, it was concluded that double absorption is the best demonstrated technology available for sulfur dioxide control. This control has the advantage of reducing sulfur dioxide emissions, producing no by-products and introducing no unfamiliar operating factors to plant operators. EPA reviewed potential improvements to the double absorption system such as reducing catalyst life from 3-5 years to 2 years. EPA rejected this alternative, however, since it reduced pre-tax profits by approximately 20 percent.

Bisulfite and ammonia scrubbing systems were also evaluated and described as feasible by EPA. These systems, however, would not be expected to result in significantly lower sulfur dioxide emission rates and, in addition, the systems would generate by-products and they would introduce a system that requires completely different operating technology. Molecular sieves have also been tried and found unacceptable because of operating difficulties.

It is recommended, for purposes of this permit application, that double absorption with catalyst screening and make-up every 3-5 years represents BACT for sulfur dioxide. This technology will also assure compliance with New Source Performance Standards.

Sulfuric Acid Mist

Sulfuric acid mist emissions and the resulting opacity, can be controlled by high efficiency mist eliminators and, theoretically, by electrostatic precipitators. Practically, precipitators are not considered as an alternative because of operating problems that would develop in the acid environment.

It has been the experience of Royster and the phosphate fertilizer industry as a whole, that the high efficiency mist eliminators are the most effective means of controlling sulfuric acid mist emissions from sulfuric acid plants.

For purposes of this permit application, the high efficiency mist eliminators are proposed by Royster as BACT for sulfuric acid mist. This control system will assure compliance with both the mass emission standard for sulfuric acid mist and the visible emission standards imposed by the New Source Performance Standards.

**GOOD ENGINEERING PRACTICE STACK HEIGHT**

Good Engineering Practice (GEP) stack height is defined as the "height necessary to insure that emissions from the stack do not result in excessive concentrations of any pollutant in the immediate vicinity of the source as a result of aerodynamic, downwash, eddies and wakes which may be created by the source itself, nearby structures, or nearby terrain obstacles."

For regulatory purposes, GEP stack height is defined by the equation:

$$H_g = H + 1.5L$$

where: $H_g$ = Good Engineering Practice Stack Height,
$H$ = Height of the structure or nearby structure, and
$L$ = Lesser dimension (height or projected width) of the structure or nearby structure.

For purposes of applying this equation, the downwind area in which a nearby structure is presumed to have a significant influence is limited to 5 times the height or width of the structure, whichever is less. Furthermore, to avoid natural atmospheric effects which may cause excessive concentrations around very low level sources, a stack height of 65 meters (213 feet) is defined as Good Engineering Practice, without the demonstration of necessity.

An analysis of the existing structures on the Royster site (Figure 3) demonstrates that neither the DAP plant nor the phosphoric plant can be considered nearby sources because of the distance of these plants from the sulfuric acid plant stack. The controlling structure is the ROP storage building; a structure 80 feet in height. The GEP stack height, based on the dimensions of the ROP storage building, would be 200 feet; the height of the existing sulfuric acid plant stack. Therefore, the existing 200 foot stack height qualifies as a Good Engineering Practice stack height and, since the physical stack height is equal to the height of nearby structures plus 1.5 times the height or projected width of the structures, the potential for downwash is essentially eliminated.

**IMPACT ON SOILS, VEGETATION AND VISIBILITY**

Since the impact of increased sulfur dioxide and sulfuric acid mist emissions on ambient air quality are less than the significant impact levels and less than the de minimus impact levels for these pollutants, no adverse impacts on soils, vegetation and visibility will occur. Furthermore, the increase in sulfuric acid production from 1400 tons per day to 1700 tons per day will result in no additional manpower requirements at Royster and hence, there will be no growth-related air quality impacts resulting from the proposed action.

If there are any comments or questions regarding the information contained herein, please feel free to contact me.

Very truly yours,

SHOLTES & KOOGLER,
ENVIRONMENTAL CONSULTANTS

John B. Koogler, Ph.D., P.E.

JBK:net

## TABLE 1

## ROYSTER COMPANY
## EXISTING SULFURIC ACID PLANT OPERATING CONDITIONS AT 1400 TPD

Permits: AC53-6458A; issued 8/28/78 and expired 8/30/79
A053-78016; current operating permit

Permit Conditions: (See Royster letter dated 5/9/84)

Production rate - 1400 tpd 100% sulfuric acid
Hours of Operation - Unrestricted (8760 hours/year)
Emission Rates -

Sulfur dioxide - 504 lbs/hr (8.64 lb/ton of acid)
Mist - Not stated (0.3 lbs/ton of acid from 17-2.600(2)(a)2.C.)

1978 → 1971
1400 TPD
504 # $SO_2$/hr
8.64 #/T
0.3 #/T mist

Operating Conditions:

Production Rate - 1400 tpd 100% sulfuric acid.
456,760 tpy (Average 1982-1984; See Royster letter dated 6/19/84)

Emission Rates -

| | |
|---|---|
| Sulfur dioxide | - 3.52 lbs/ton of acid (See FDER test results attached to Royster permit application and data submitted by Royster in letter dated 5/9/84) |
| Mist | - 0.06 lbs/ton of acid (same ref.) |

ACTUAL EMISSION 3.52 #/T $SO_2$

.06 # mist/T

| | |
|---|---|
| Stack Height | - 200 feet |
| Stack Diameter | - 7.0 feet |
| Stack Gas Temp. | - 180°F |
| Stack Gas Flow | - 76,076 Acfm |

Annual Emissions -

Sulfur dioxide - 456,760 ton/yr x 3.52 lb/ton x 1/2000
= 803.9 tpy.

Mist - 456,760 ton/yr x 0.06 lb/ton x 1/2000
= 13.7 tpy.

NOx - 456,760 ton/yr x 78,250 $ft^3$/ton of acid x 2.1 x $10^{-6}$ lb NOx/$ft^3$* x 1/2000
= 37.5 tpy.

ACTUAL EMISSION
803.9 TPY $SO_2$
13.7 TPY mist
37.5 TPY NOx

* From PSD-FL-034

## TABLE 2

### ROYSTER COMPANY
### PROPOSED SULFURIC ACID PLANT OPERATING CONDITIONS AT 1700 TPD

Operating Conditions:

Production rate - 1700 tpd 100% sulfuric acid
- 595,000 tpy (based on 350 days per year operation)

Proposed 1700 TPD $H_2SO_4$
4#/T $SO_2$
0.15#/T MIST

Emission rates -

| | |
|---|---|
| Sulfur dioxide | - 4.0 lbs/ton (NSPS) |
| Mist | - 0.15 lbs/ton (NSPS) |
| Stack Height | - 200 feet |
| Stack Diameter | - 7.0 feet |
| Stack Gas Temp. | - 188°F |
| Stack Gas Flow | - 92,380 Acfm |

Annual Emissions -

| | |
|---|---|
| Sulfur dioxide | - 595,000 tons/yr x 4.0 lb/ton x 1/2000 = 1190.0 tpy. |
| Mist | - 595,000 ton/yr x 0.15 lb/ton x 1/2000 = 44.6 tpy. |
| NOx | - 595,000 tons/yr x 78,250 $ft^3$/ton of acid x 2.1 x $10^{-6}$ lb NOx/$ft^3$ x 1/2000 = 48.9 tpy. |

Proposed
1190 TPY $SO_2$
44.6 TPY MIST
48.9 TPY NOx

TABLE 3

ROYSTER COMPANY
EMISSION RATE INCREASES RESULTING FROM PROPOSED
PRODUCTION RATE INCREASE
(FROM 1400 TPD TO 1700 TPD)

| POLLUTANT | EMISSION RATE INCREASE (TPY) | SIGNIFICANT EMISSION RATE INCREASE (TPY) |
|---|---|---|
| Sulfur Dioxide | 386.1 | 40 |
| Acid Mist | 30.9 | 7 |
| NOx | 11.4 | 40 |

TABLE 4

ROYSTER COMPANY
SOURCE INPUT DATA FOR AIR QUALITY REVIEW

Existing Conditions (1400 tons/day)

Emission rates:

| | |
|---|---|
| Sulfur dioxide | - (1400 tpd/24 hr/day) x 3.52 lb/ton x 0.126 g/sec/lb/hr |
| | = 25.87 g/sec. |
| Mist | - (1400/24) x 0.06 lb/ton x 0.126 |
| | = 0.44 g/sec. |
| Stack Height | = 200 feet = 61.0 meters |
| Stack Diameter | = 7.0 feet = 2.13 meters |
| Stack Temp. | = 180°F = 355°K |
| Stack Velocity | = (76,076 Acfm)/[(7.0 x 7.0 x $\pi$ /4)(60)(3.28)] |
| | = 10.0 m/sec. |

Proposed Conditions (1700 tons/day)

Emission Rates:

| | |
|---|---|
| Sulfur Dioxide | - (1700 tpd/24 hr/day) x 4.0 lb/ton x 0.126 |
| | = 35.70 g/sec. |
| Mist | - (1700/24) x 0.15 lb/ton x 0.126 |
| | = 1.34 g/sec. |
| Stack Height | = 200 feet = 61.0 meters |
| Stack Diameter | = 7.0 feet = 2.13 meters |
| Stack Temp. | = 188°F = 360°K |
| Stack Velocity | = 92,380/[(7.0 x 7.0 x $\pi$/4)(60)(3.28)] |
| | = 12.20 m/sec. |

TABLE 5

AMBIENT IMPACTS RESULTING FROM THE NET INCREASE IN SULFURIC ACID MIST EMISSIONS CAUSED BY PRODUCTION RATE INCREASE (FROM 1400 TPD TO 1700 TPD)

Acid Mist

Model - CRSTER
Meteorological Data - 1974-1978 Orlando, Florida

| YEAR | 24-HOUR ACID MIST IMPACT ($ug/m^3$) EXISTING | PROPOSED | NET INCREASE(1) |
|---|---|---|---|
| 1974 | 0.24 | 0.66 | 0.42 |
| 1975 | 0.23 | 0.64 | 0.41 |
| 1976 | 0.23 | 0.63 | 0.40 |
| 1977 | 0.24 | 0.64 | 0.40 |
| 1978 | 0.27 | 0.75 | 0.48 |
| De Minimus Impact(2) | 1.0 | 1.0 | 1.0 |

(1) Approximate net increase; based on difference between the maximum impacts under existing and proposed conditions.

(2) Suggested de minimus impact; Health Impacts, Emissions, and Emission Factors for Noncriteria Pollutants Subject to De Minimus Guidelines and Emitted from Stationary Conventional Combustion Processes, U.S. EPA, June, 1980.

TABLE 6

ROYSTER COMPANY
AMBIENT IMPACTS RESULTING FROM THE NET INCREASE IN
SULFUR DIOXIDE EMISSIONS CAUSED BY PROPOSED PRODUCTION RATE INCREASE
(FROM 1400 TPD TO 1700 TPD)

Sulfur Dioxide

Model - ISC-ST with calm processor
Meteorological Data - 1974-1978 Orlando, Florida

| YEAR | SULFUR DIOXIDE IMPACT ($ug/m^3$)[1] ANNUAL[2] | 24-HOUR | 3-HOUR |
|---|---|---|---|
| 1974 | 0.2 | 2.7 | 17.6 |
| 1975 | 0.2 | 2.6 | 13.3 |
| 1976 | 0.2 | 2.7 | 15.4 |
| 1977 | 0.2 | 2.8 | 12.9 |
| 1978 | 0.3 | 3.9 | 15.0 |
| De Minimus Impact | --- | 13.0 | ---- |
| Significant Impact | 1.0 | 5.0 | 25.0 |

(1) Impact of the plant as proposed, minus the impact of the plant as actually operated.

(2) Annual impact with source operating 100% of time. The inpact, incorporating annual operating factors, will be slightly different.

TABLE 7

SOURCES USED IN AIR QUALITY MODELING

| Location | ID | Type | Description | SO2 (gm/sec) | Height (meters) | Diameter (meters) | Velocity (m/sec) | Temp. (deg K) | X-Coord (km) | Y-Coord (km) |
|---|---|---|---|---|---|---|---|---|---|---|
| ROY | 101 | New | H2SO4 (1700) | 35.70 | 61.00 | 2.13 | 12.20 | 360.0 | 406.800 | 3085.100 |
| ROY | 10102 | | DAP/GTSP | 1.88 | 31.10 | 2.67 | 8.26 | 322.0 | 406.800 | 3085.200 |
| USSAC | 201 | New | Ft.Meade - H2SO4 1 | 63.00 | 53.40 | 2.59 | 15.91 | 355.0 | 416.120 | 3068.620 |
| USSAC | 202 | New | Ft.Meade - H2SO4 2 | 63.00 | 53.40 | 2.59 | 15.91 | 355.0 | 416.120 | 3068.670 |
| USSAC | 10206 | | Ft.Meade - GTSP Dryer | 9.60 | 28.40 | 1.45 | 9.33 | 314.0 | 415.920 | 3068.890 |
| USSAC | 10207 | | Ft.Meade - Rock Dryer | 34.80 | 15.90 | 1.83 | 11.04 | 336.0 | 415.860 | 3068.550 |
| USSAC | 10201 | | Bartow - H2SO4 | 42.00 | 29.00 | 2.13 | 8.30 | 314.0 | 413.200 | 3086.300 |
| USSAC | 10202 | | Bartow - Rock Dryer | 34.10 | 15.80 | 1.83 | 11.00 | 326.0 | 413.200 | 3086.300 |
| USSAC | 10203 | | Bartow - DAP Dryer | 0.80 | 40.40 | 2.13 | 14.50 | 314.0 | 413.200 | 3086.300 |
| AGRICO | 301 | New | DAP | 7.36 | 38.10 | 3.10 | 14.60 | 328.0 | 407.380 | 3071.700 |
| AGRICO | 302 | New | #12 H2SO4 | 42.00 | 45.70 | 2.90 | 9.50 | 350.0 | 407.580 | 3071.340 |
| AGRICO | 10304 | | #11 H2SO4 | 28.35 | 45.70 | 2.70 | 9.90 | 350.0 | 407.570 | 3071.240 |
| AGRICO | 10305 | | #10 H2SO4 | 32.13 | 45.70 | 2.70 | 9.90 | 350.0 | 407.520 | 3071.240 |
| AGRICO | 10306 | | GTSP | 19.35 | 42.70 | 2.70 | 12.90 | 319.0 | 407.520 | 3071.520 |
| AMAX | 401 | New | Big 4 - Boiler | 0.60 | 8.20 | 0.41 | 7.57 | 505.0 | 394.800 | 3069.720 |
| AMAX | 402 | New | Big 4 - Rock Dryer | 16.35 | 30.50 | 1.82 | 7.26 | 334.0 | 394.850 | 3069.770 |
| AMAX | 10403 | | Piney Point | 37.80 | 61.00 | 1.90 | 13.40 | 322.0 | 348.500 | 3057.300 |
| BPI | 501 | New | Brewster (Composite) | 13.40 | 38.10 | 2.44 | 15.20 | 339.0 | 389.500 | 3068.000 |
| BPI | 10502 | | Brewster (Composite) | 35.70 | 38.10 | 2.44 | 15.20 | 339.0 | 389.500 | 3068.000 |
| CF | 602 | New | DAP | 5.26 | 42.70 | 2.84 | 18.87 | 336.0 | 408.200 | 3082.000 |
| CF | 603 | New | #7 H2SO4 | 26.29 | 61.60 | 2.44 | 9.79 | 351.0 | 408.200 | 3081.800 |
| CF | 10604 | | #3 H2SO4 | 25.20 | 34.50 | 1.30 | 15.00 | 316.0 | 408.200 | 3081.700 |
| CF | 10605 | | #6 H2SO4 | 18.14 | 63.40 | 2.13 | 6.87 | 351.0 | 408.100 | 3081.800 |
| CF | 10606 | | #4 H2SO4 | 21.87 | 34.50 | 1.30 | 15.00 | 316.0 | 408.300 | 3081.700 |
| CF | 10607 | | #5 H2SO4 | 23.18 | 63.40 | 2.13 | 6.87 | 347.0 | 408.200 | 3081.800 |
| CF | 10608 | | 3-DAP | 3.65 | 38.60 | 2.19 | 11.00 | 341.0 | 408.100 | 3082.100 |
| CLM | 701 | | Chloride Metals | 21.02 | 30.00 | 0.61 | 20.00 | 375.0 | 361.800 | 3088.300 |
| CSERVE | 802 | New | Conserve | 42.00 | 45.70 | 2.30 | 10.30 | 352.0 | 398.400 | 3084.200 |
| CSERVE | 10803 | | Conserve | 18.20 | 10.00 | 0.80 | 11.00 | 533.0 | 398.400 | 3084.200 |
| CSERVE | 10804 | | Conserve | 17.20 | 24.40 | 1.70 | 5.00 | 330.0 | 398.400 | 3084.200 |
| ELECT | 10901 | | Electrophos | 6.20 | 25.60 | 2.10 | 8.00 | 322.0 | 405.600 | 3079.400 |
| ESTECH | 11001 | | Estech SAP | 32.20 | 30.80 | 2.10 | 3.90 | 358.0 | 411.500 | 3074.200 |
| ESTECH | 11002 | | Estech Dryer | 51.50 | 18.50 | 3.00 | 7.00 | 340.0 | 411.500 | 3074.200 |
| EVANS | 1101 | New | Dryer | 9.37 | 25.90 | 1.00 | 17.30 | 346.0 | 383.300 | 3135.800 |
| EVANS | 11102 | | Dryer | 24.60 | 25.90 | 1.00 | 17.30 | 346.0 | 383.300 | 3135.800 |
| EVANS | 11103 | | Boilers | 28.70 | 12.20 | 1.10 | 11.90 | 505.0 | 383.300 | 3135.800 |
| FARM | 11202 | | 1-2 H2SO4 | 56.42 | 30.50 | 1.40 | 20.73 | 316.0 | 409.500 | 3079.500 |
| FARM | 11203 | | 3-4 H2SO4 | 20.75 | 30.50 | 2.29 | 11.04 | 347.0 | 409.500 | 3079.500 |
| FARM | 11204 | | DAP | 1.52 | 39.30 | 2.29 | 10.56 | 330.0 | 409.500 | 3079.500 |
| FCS | 1301 | New | Kiln and Power Plant | 157.50 | 91.50 | 4.88 | 14.66 | 389.0 | 360.008 | 3162.392 |
| FPC | 1401 | New | Crystal River | 2017.60 | 182.90 | 6.90 | 27.40 | 398.0 | 334.400 | 3204.510 |
| FPC | 1402 | New | Crystal River | -2173.00 | 152.40 | 4.60 | 45.60 | 420.0 | 334.400 | 3204.510 |
| FPC | 11403 | | Crystal River | 4803.00 | 152.40 | 4.60 | 45.60 | 420.0 | 334.400 | 3204.510 |
| FPC | 11404 | | Higgins 1-3 | 523.80 | 52.90 | 3.80 | 7.70 | 424.0 | 336.500 | 3098.200 |
| FPC | 11405 | | #1 Anclote | 1680.50 | 152.40 | 7.60 | 6.50 | 416.0 | 324.500 | 3118.600 |
| FPC | 11406 | | #2 Anclote | 1680.50 | 152.40 | 7.30 | 15.60 | 416.0 | 324.500 | 3187.500 |
| FPC | 11407 | | Bartow 2 | 448.40 | 91.50 | 2.70 | 31.10 | 422.0 | 342.400 | 3082.700 |
| FPC | 11408 | | Bartow 3 | 710.00 | 91.50 | 3.40 | 29.10 | 430.0 | 342.400 | 3082.700 |
| FPL | 11501 | | FPL Manatee (Composite) | 1465.80 | 152.10 | 7.90 | 20.70 | 425.0 | 367.100 | 3053.800 |

## TABLE 7

## SOURCES USED IN AIR QUALITY MODELING
(Continued)

| Location | ID | Type | Description | SO2 (gm/sec) | Height (meters) | Diameter (meters) | Velocity (m/sec) | Temp. (deg K) | X-Coord (km) | Y-Coord (km) |
|---|---|---|---|---|---|---|---|---|---|---|
| GARD | 1601 | New | Gardinier (Composite) | -210.26 | 36.50 | 2.00 | 11.80 | 344.0 | 363.400 | 3082.400 |
| GARD | 11602 | | Gardinier (Composite) | 413.60 | 29.40 | 2.10 | 9.10 | 333.0 | 363.400 | 3082.400 |
| GCL | 11701 | | Gulf Coast Lead | 25.90 | 30.50 | 0.61 | 22.40 | 350.0 | 363.900 | 3093.850 |
| GPI | 11801 | | Gen'l Portland (Composite) | 101.00 | 44.30 | 4.72 | 6.60 | 473.0 | 358.000 | 3090.600 |
| IMC | 1901 | New | IMC Noralyn | 30.64 | 13.70 | 1.22 | 40.40 | 330.0 | 414.700 | 3080.300 |
| IMC | 11902 | | IMC Noralyn | 9.00 | 17.00 | 1.30 | 36.70 | 343.0 | 414.700 | 3080.300 |
| IMC | 11903 | | IMC Kingsford | 11.60 | 21.30 | 2.10 | 12.90 | 344.0 | 398.200 | 3075.700 |
| LKU | 2001 | New | Lakeland Utilities #1 | 393.60 | 76.20 | 4.90 | 19.70 | 354.0 | 408.500 | 3105.800 |
| LKU | 2002 | New | Lakeland Utilities #2 | 21.20 | 47.70 | 3.10 | 11.70 | 389.0 | 408.500 | 3105.800 |
| LKU | 12003 | | Larsen 7 | 7.52 | 50.30 | 3.10 | 3.40 | 422.0 | 409.200 | 3102.800 |
| LKU | 12004 | | McIntosh 1 | 139.00 | 47.70 | 2.70 | 15.10 | 405.0 | 408.500 | 3105.800 |
| LYKES | 12101 | | Boilers (3) | 152.60 | 22.90 | 1.40 | 18.20 | 441.0 | 383.500 | 3139.200 |
| LYKES | 12102 | | D1 & D2 | 57.60 | 22.90 | 0.90 | 27.80 | 345.0 | 383.500 | 3139.200 |
| MOBIL | 2201 | New | Mobil | 2.40 | 25.90 | 2.30 | 16.00 | 339.0 | 398.000 | 3085.300 |
| MOBIL | 12202 | | Mobil | 56.50 | 30.50 | 2.00 | 11.00 | 350.0 | 398.000 | 3085.300 |
| NWALES | 2301 | New | 1 59 95 New Wales | 57.75 | 60.70 | 2.60 | 13.40 | 349.7 | 396.560 | 3078.640 |
| NWALES | 2302 | New | 1 59 27 New Wales | 3.78 | 52.40 | 2.40 | 13.00 | 321.9 | 396.750 | 3079.350 |
| NWALES | 2303 | New | 1 59 33 New Wales | 5.36 | 52.40 | 2.40 | 7.10 | 319.1 | 396.830 | 3079.430 |
| NWALES | 2304 | New | 1 59 96 New Wales | 5.54 | 36.60 | 1.80 | 20.80 | 319.1 | 396.450 | 3079.150 |
| NWALES | 2305 | New | 1 59 94 New Wales | 57.75 | 60.70 | 2.60 | 13.40 | 349.7 | 396.490 | 3078.640 |
| NWALES | 12306 | | 3 59 02 New Wales | 42.00 | 61.00 | 2.50 | 10.00 | 350.2 | 396.600 | 3078.750 |
| NWALES | 12307 | | 3 59 09 New Wales | 0.82 | 36.60 | 2.10 | 15.60 | 319.1 | 396.540 | 3079.030 |
| NWALES | 12308 | | 3 59 03 New Wales | 42.00 | 61.00 | 2.50 | 10.00 | 350.2 | 396.530 | 3078.750 |
| NWALES | 12309 | | 3 59 04 New Wales | 42.00 | 61.00 | 2.50 | 10.00 | 350.2 | 396.450 | 3078.750 |
| NWALES | 12310 | | 3 59 13 New Wales | 4.88 | 29.00 | 1.70 | 17.20 | 564.1 | 396.560 | 3078.810 |
| NWALES | 12311 | | 3 59 10 New Wales | 1.89 | 36.60 | 1.80 | 20.40 | 325.2 | 396.550 | 3079.150 |
| PTI | 2401 | New | Phostech | 2.84 | 27.40 | 1.00 | 29.00 | 322.0 | 405.200 | 3078.500 |
| TECo | 2601 | New | Big Bend 1-3 RED. | -1764.00 | 149.40 | 7.30 | 12.90 | 415.0 | 361.500 | 3075.000 |
| TECo | 2602 | New | Big Bend 4 | 436.50 | 149.40 | 7.32 | 20.00 | 342.0 | 361.600 | 3075.000 |
| TECo | 12603 | | Big Bend 1-3 B.L. | 8064.00 | 149.40 | 7.30 | 12.90 | 415.0 | 361.500 | 3075.000 |
| TECo | 12604 | | Gannon (Composite) | 1649.60 | 93.30 | 3.90 | 26.50 | 430.0 | 360.000 | 3087.500 |
| TECo | 12605 | | Hookers Pt. (Composite) | 388.90 | 85.40 | 3.40 | 15.90 | 402.0 | 358.000 | 3091.000 |
| WRG | 2702 | New | 5-6 H2SO4 | 39.69 | 61.00 | 2.80 | 8.46 | 350.0 | 409.900 | 3086.800 |
| WRG | 12702 | | DAP | 3.51 | 40.40 | 3.35 | 13.37 | 329.0 | 409.800 | 3068.800 |
| WRG | 12703 | | 300X | 6.27 | 30.50 | 2.03 | 14.54 | 329.0 | 409.900 | 3086.900 |
| WRG | 12704 | | Dryer | 24.40 | 15.30 | 2.10 | 41.73 | 333.0 | 409.600 | 3085.900 |
| WRG | 12705 | | #4 H2SO4 | 22.28 | 61.00 | 2.80 | 8.46 | 350.0 | 409.900 | 3086.900 |

TABLE 8

SUMMARY OF SULFUR DIOXIDE IMPACTS FROM ALL SOURCES WITHIN 50 KM OF ROYSTER

ROYSTER COMPANY
POLK COUNTY, FLORIDA

| Year | Annual | | | 3-Hr | | | 24-Hr | | |
|---|---|---|---|---|---|---|---|---|---|
| | Royster | | All | Royster | | All | Royster | | All |
| | Impact ($ug/m^3$) | Area Influence (km) | Source Impact ($ug/m^3$) | Impact ($ug/m^3$) | Area Influence (km) | Source Impact ($ug/m^3$) | Impact ($ug/m^3$) | Area Influence (km) | Source Impact ($ug/m^3$) |
| 1974 | 1.3 | <4.0 | 41.5 | 123 | <10.0 | 701 | 18 | ~10.4 | 221 |
| 1975 | 1.5 | <4.0 | 41.5 | 72 | 7.5 | 674 | 18 | ~10.6 | 175 |
| 1976 | 1.6 | <7.5 | 42.0 | 95 | <7.5 | 757 | 18 | ~10.1 | 207 |
| 1977 | 1.8 | <7.5 | 42.0 | 79 | <10.0 | 620 | 17 | ~13.1 | 215 |
| 1978 | 1.9 | <5.0 | 41.1 | 94 | <10.0 | 550 | 20 | ~11.9 | 201 |
| Std. | 60 | 1.0 $ug/m^3$ | 60 | 1300 | 25 $ug/m^3$ | 1300 | 260 | 5 $ug/m^3$ | 260 |

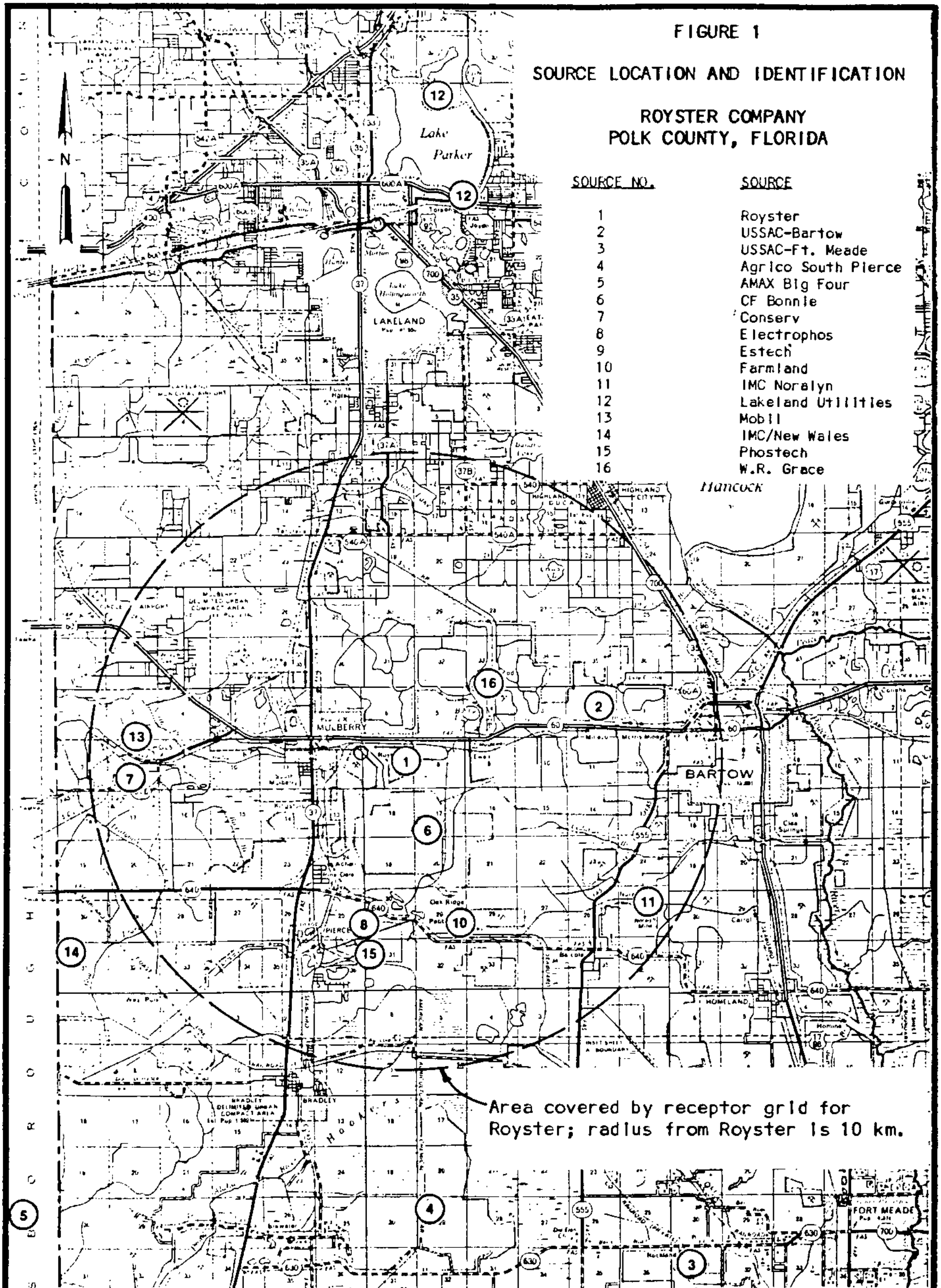
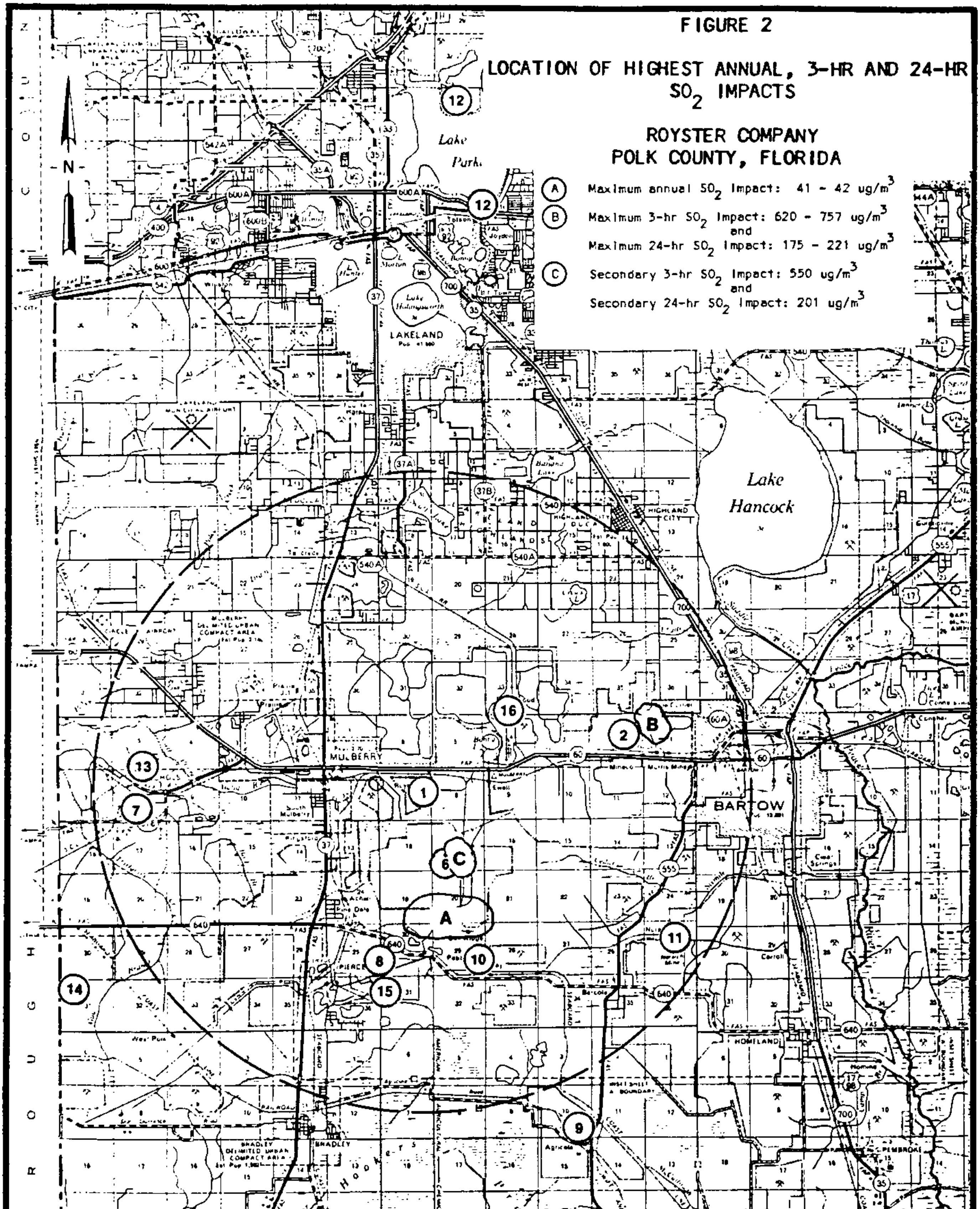


FIGURE 1
SOURCE LOCATION AND IDENTIFICATION
ROYSTER COMPANY
POLK COUNTY, FLORIDA
SOURCE NO. SOURCE
1 Royster
2 USSAC-Bartow
3 USSAC-Ft. Meade
4 Agrico South Pierce
5 AMAX Big Four
6 CF Bonnie
7 Conserv
8 Electrophos
9 Estech
10 Farmland
11 IMC Noralyn
12 Lakeland Utilities
13 Mobil
14 IMC/New Wales
15 Phostech
16 W.R. Grace
Area covered by receptor grid for Royster; radius from Royster is 10 km.
Lake Parker
LAKELAND
MULBERRY
BARTOW
HOMELAND
BRADLEY
FORT MEADE
Hancock
N




SHOLTES & KOOGLER

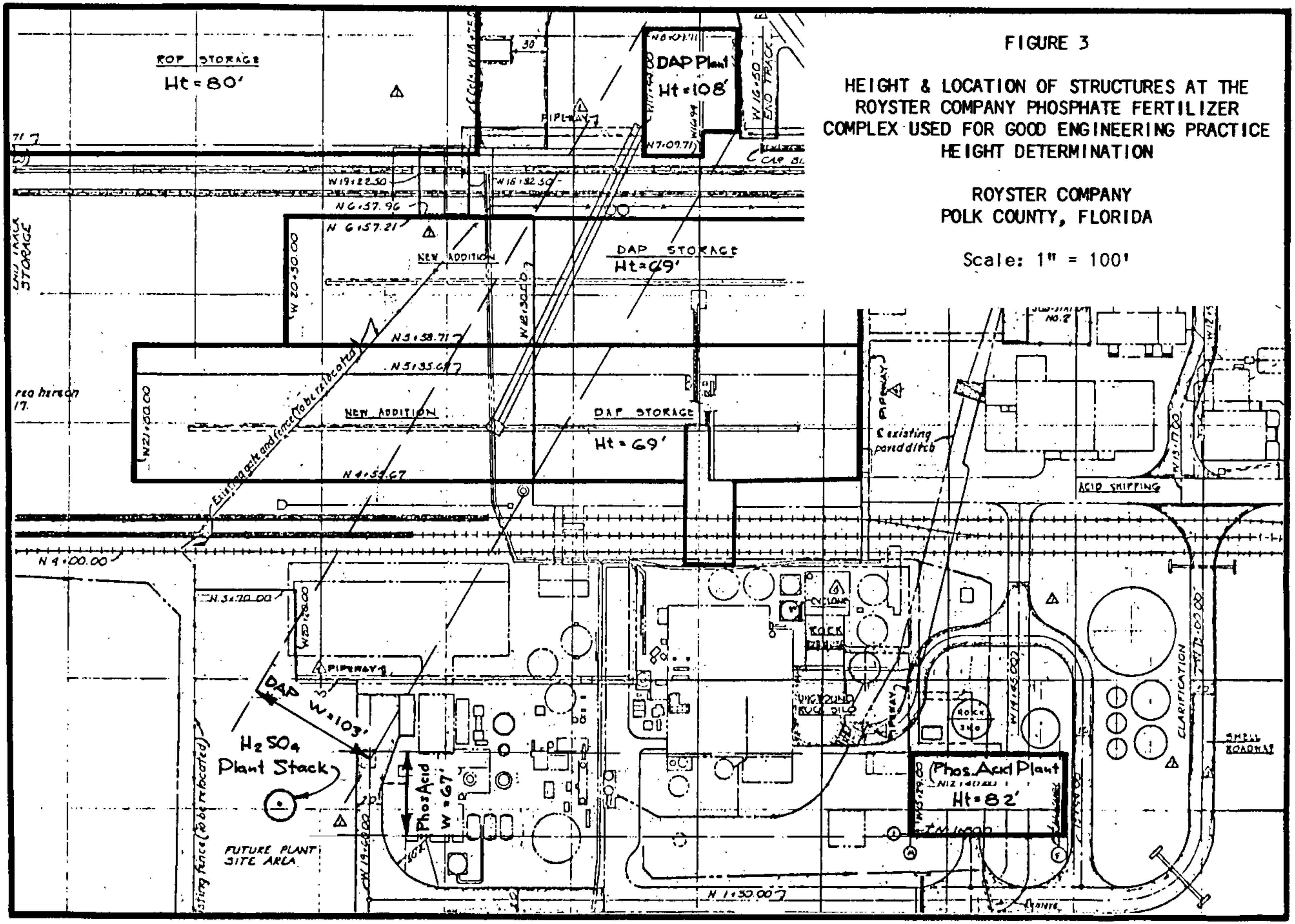



FIGURE 3

HEIGHT & LOCATION OF STRUCTURES AT THE ROYSTER COMPANY PHOSPHATE FERTILIZER COMPLEX USED FOR GOOD ENGINEERING PRACTICE HEIGHT DETERMINATION

ROYSTER COMPANY
POLK COUNTY, FLORIDA

Scale: 1" = 100'

SHOLTES & KOOGLER