



Partial Project Experience List  
Of  
Turnell Corp's Personnel

November 19, 2010

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# 1 Partial List of Projects

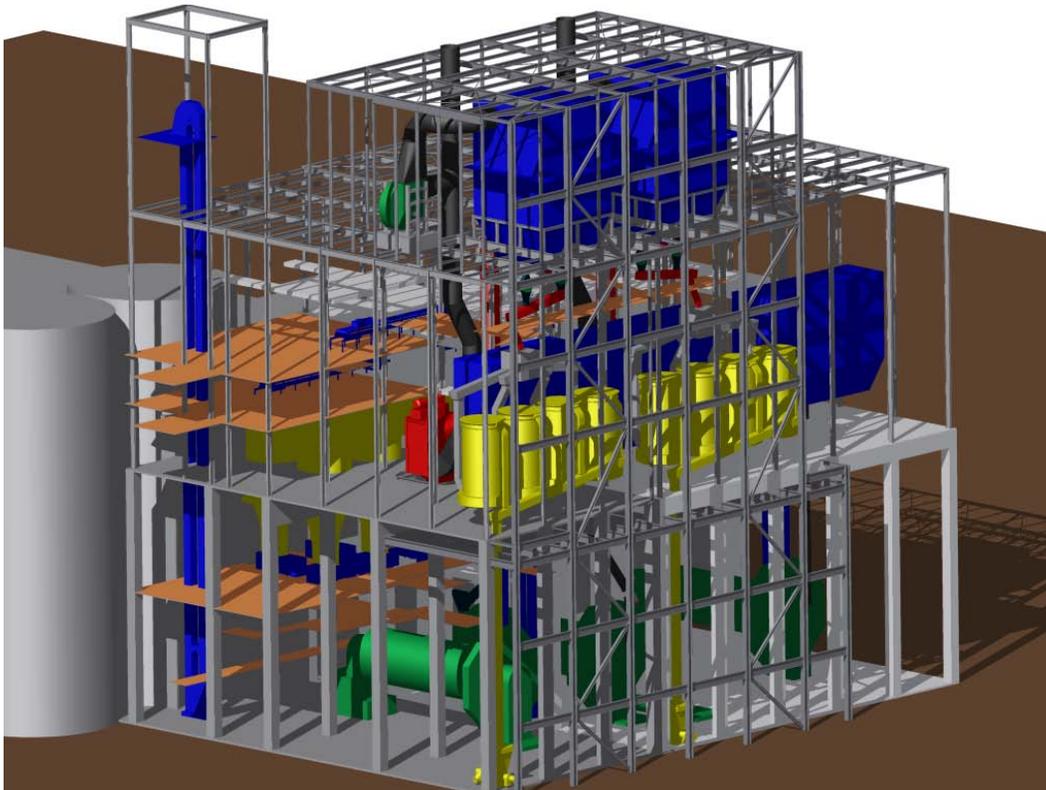
## 1.1 Experience

Turnell Corp.'s personnel have had many years of experience. The projects listed in this section are meant to provide a sample of projects only. Please contact us to discuss any specific type project experience.

## 1.2 Cement Plant Experience

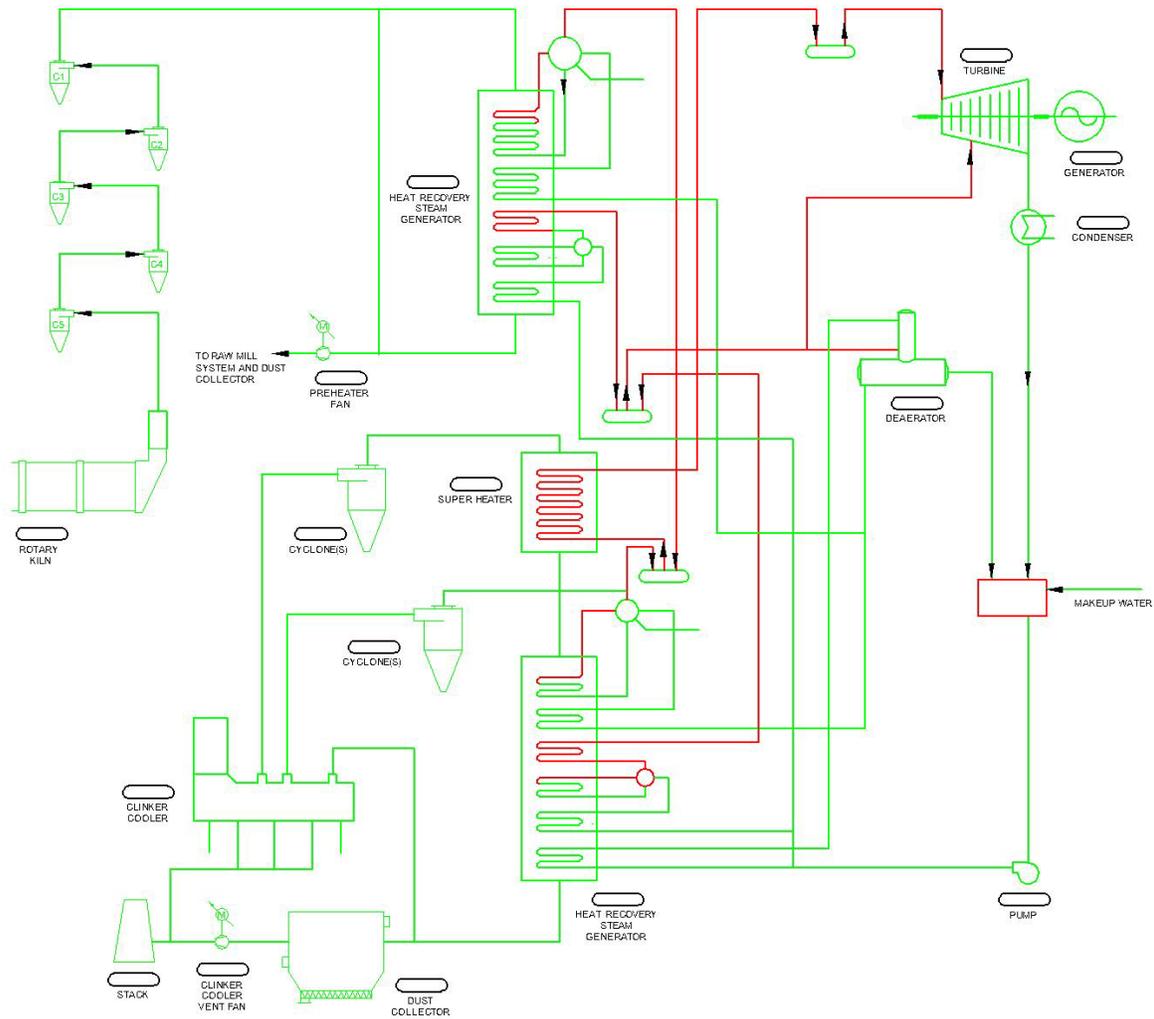
### 1.2.1 Raw Grinding Mill Systems to Cement Mill Systems Conversion

Turnell Corp provided engineering services to evaluate the conversion of two raw mill systems to cement mill systems. Tasks included determining the optimum arrangement of the systems to minimize capital costs, completing preliminary structural design to support the new equipment and loads, and preparing a capital cost estimate.



## 1.2.2 Waste Heat Recovery Power Generation Systems

Turnell Corp completed a feasibility study for the installation of a waste heat recovery power generation system. Options considered included the conventional Rankine Cycle system with water as the fluid and the Kalina Cycle system. The figure below shows the conventional Rankine Cycle system with water as the fluid.



## 1.2.3 Vertical Roller Mill System for Cement Grinding

Turnell Corp provided engineering services for a cement grinding system that uses a vertical roller mill. Scope of work included project management, general arrangement preparation, process duct fabrication drawings, chute fabrication drawings, bin fabrication drawings, fugitive dust collection drawings, and equipment procurement assistance.

### 1.2.4 Coal Firing Systems

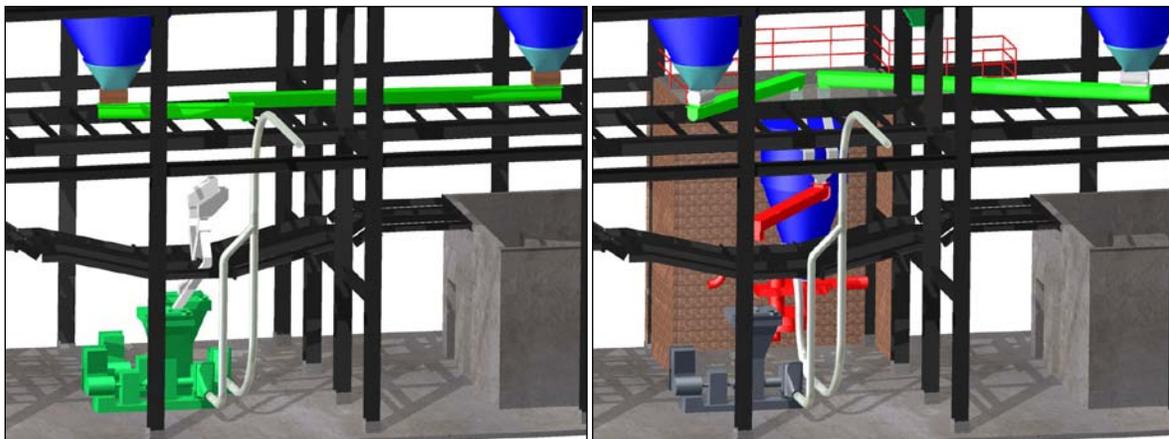
Process evaluation and recommendations to upgrade existing fuel firing systems at four cement plants to burn 100% Bijao coal. Bijao coal is a low rank coal that contains high free and inherent moisture contents, and high volatile matter content. It is also susceptible to spontaneous auto-ignition similar to Powder River Basin Coal. Systems evaluated include direct fired and indirect fired systems. Recommendations included replacing existing coal mills with larger units, modifications to material handling systems, burner design and upgrading safety controls.

### 1.2.5 Fly Ash Handling System

Turnell Corp provided engineering services for the upgrade of an existing fly ash handling system. The objectives were to eliminate occasional flushing problems and to improve the accuracy of metering the fly ash to the calciner. The figures below show the system before modifications and the proposed system after the modifications. Modifications included replacing two rotary valves with two rotary feeders, replacing two impact flow meters and a F-K pump with a Pfister pneumatic weigh feeder. One of the existing F-K pumps was kept as backup.

**Before**

**After**



### 1.2.6 Cement Loadout System

Turnell Corp provided detail engineering services for the replacement of an existing fixed position loading spout with a new movable loading spout. The objective was to reduce the time it took to position trucks and railcars under the loading spout. Prior to the modification, trucks would have to go back and forth

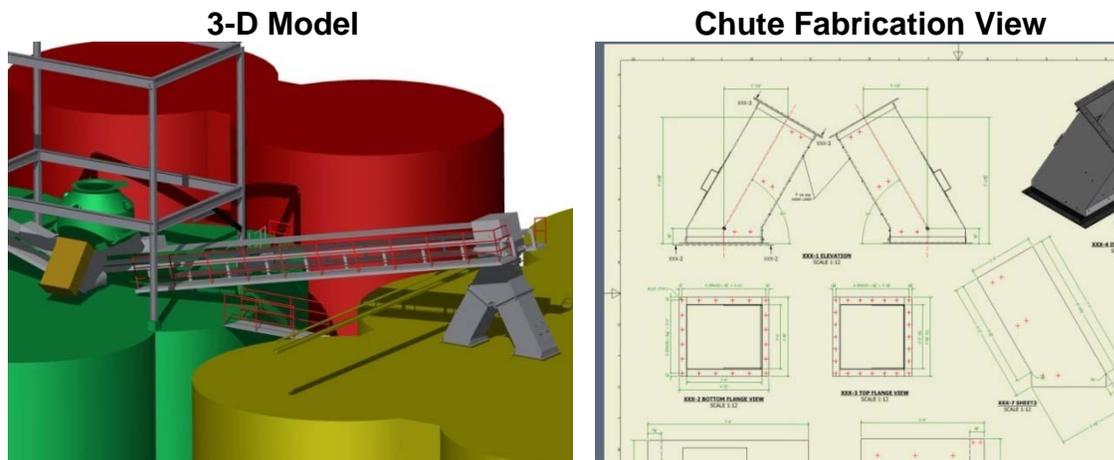
several times until the hatch covers were positioned directly under the fixed position spout. After the modifications, the loading spout could be moved within a 3 ft radius from its center position; thereby, eliminating the need to go back and forth several times.

### 1.2.7 SO<sub>2</sub> Control Using Micro-Fine Lime Injection

Turnell Corp provided engineering services for the determination of the optimum system to spray lime slurry into an existing and a new kiln system. The design scope included the bulk lime receiving system, lime grinding system, lime slaking system, and lime slurry spray system. Particular attention was given to the potential buildup problems associated with calcium hydroxide in pipes.

### 1.2.8 Limestone Additive to Cement Mill Systems

Turnell Corp provided engineering services for the material handling modifications to add limestone to the existing cement mill systems. Modifications included adding the capability to feed limestone to two silo interstices and limestone withdrawal from these interstices to two cement mill systems. The 3-D model below shows the new belt conveyor, diverter gate and chutes. A few views from the chute fabrication drawings are also shown.



### 1.2.9 NO<sub>x</sub> Control using a SNCR System

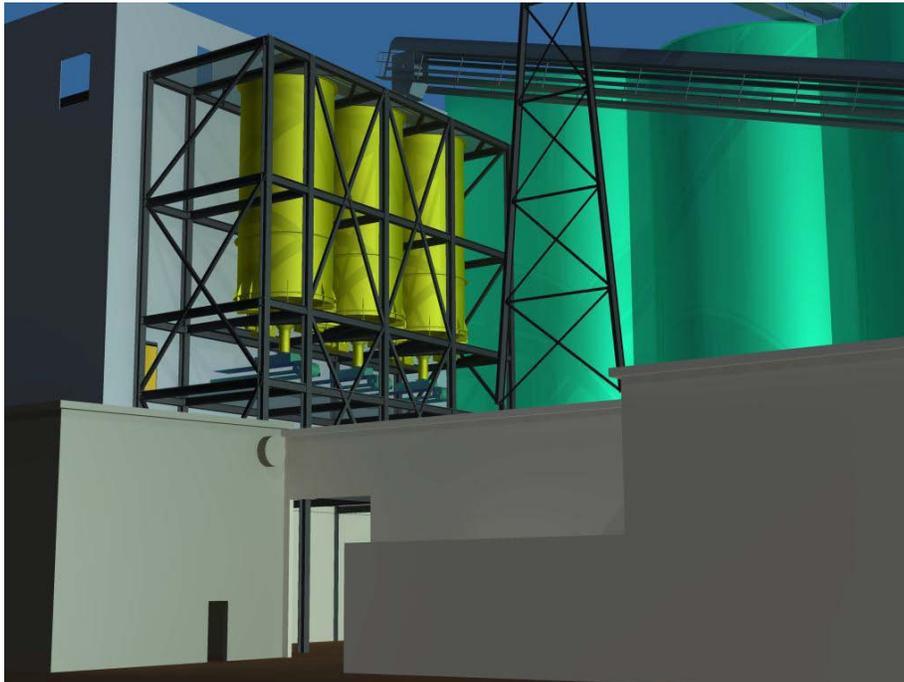
Turnell Corp provided engineering services to determine the optimum SNCR system to spray the solution into an existing and a new kiln system. The scope included the urea receiving system, urea processing system and the spray system.

### 1.2.10 Chemical Gypsum System

Turnell Corp completed a feasibility study to evaluate the use of process chemical gypsum for use in cement mill systems located at different plants. The chemical gypsum is a byproduct from the fertilizer production industry and contains significant quantities of chlorine and phosphorus. The scope included design of a system to process the chemical gypsum to make it acceptable for use in the cement mill system to replace natural gypsum. The process included a receiving system, a washing and dewatering system, and a bulk loadout system. Particular attention was given to the dewatering system and material handling challenges.

### 1.2.11 Synthetic Gypsum System

Turnell Corp completed a feasibility study and detail engineering services to design a system to replace all the natural gypsum used in the three cement mill systems with synthetic gypsum. Particular attention was given to the material handling challenges of synthetic gypsum. Several options were considered. The picture below shows one option that used three live bottom bins.



### 1.2.12 Flash Dryer Addition to a Cement Mill System

Turnell Corp's personnel provided engineering services for a flash dryer system to dry additives prior to feeding it into the cement mill. This system included the flash dryer, vent system, hot gas generator, and mechanical feed system.

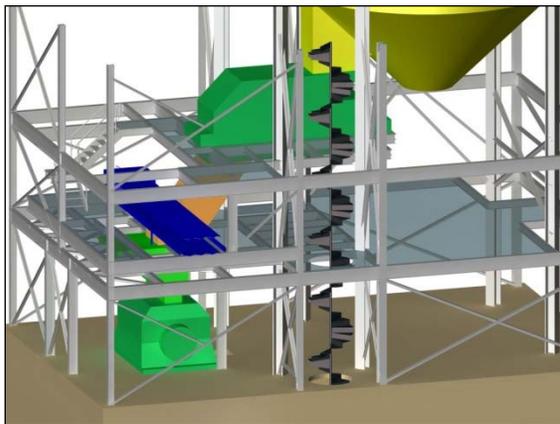
### 1.2.13 Cement Additive Dryer for a Cement Mill System

Turnell Corp's personnel completed a feasibility study that included an engineering evaluation of different types of dryers for use in this application. Types of dryer evaluated included rotary dryers, flash dryers, cement mill pre-drying chamber, and the Hazemag Rapid Dryer. A rotary dryer system was selected for this application.

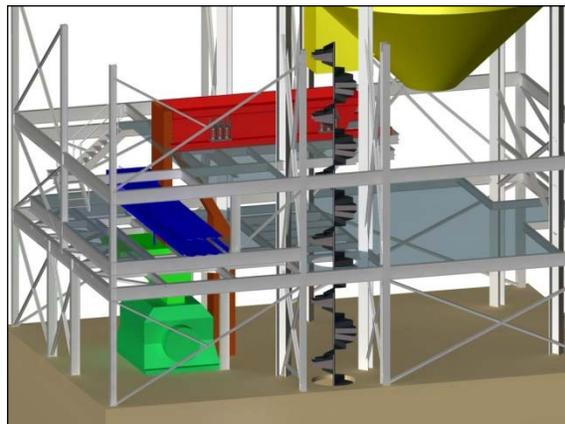
### 1.2.14 Secondary Crusher System Modification

Turnell Corp provided engineering services to modify an existing secondary crusher system from producing a minus 1.5-inch product to producing a minus 4-inch product. This modification was part of a plant expansion that eliminated the use of ball mills for raw grinding. The plant expansion uses a vertical roller mill for raw grinding. The scope included replacing an existing apron conveyor with a vibrating grizzly feeder. The vibrating grizzly feeder separates the plus 4-inch material from the minus 4-inch material. The plus 4-inch material will be fed directly to the existing hammer mill. The minus 4-inch material will bypass the existing crusher. The hammer mill rotor was also changed to produce a coarser product.

**Before**



**After**



### **1.2.15 Solid Fuel Grinding System**

Turnell Corp's personnel engineered a solid fuel, indirect firing system that uses a refurbished Tirax ball mill. The solid fuels used are coal, petcoke, and flexicoke. This system uses cooler vent air as a source of heat.

### **1.2.16 Overland Belt Conveyor**

Turnell Corp's personnel designed an 880 tph overland belt conveyor using Pro-Belt conveyor analysis software to determine belt tensions, radius of curvature etc. The material from the quarry crusher is transported approximately 2 miles by this belt conveyor system. The conveyor construction includes eight (8) locations where the materials are transferred from one belt to the next. The entire system is a covered conveyor and transfer points are fully enclosed. Each of the transfer points is provided with a bag house to capture and control fugitive dust.

### **1.2.17 Plant Expansion**

Turnell Corp's personnel provided engineering assistance on a feasibility study and preliminary engineering project for a plant expansion of a wet process to a semi-dry process. Technologies evaluated included converting the system to a semi-dry system that was fed with raw feed that contained a moisture content of 35 percent, and semi-dry system that was fed with a raw feed with a 22 percent moisture content. Drying technologies considered for the 22 percent moisture system included a centrifuge, filter press, and vacuum filter. Other equipment included a new wet ball mill for raw grinding, and new HPGR and classifier in semi-finish mode with existing finish mill.

### **1.2.18 Plant Expansion**

Turnell Corp's personnel provided engineering assistance on a feasibility study for a new calcium aluminate line that utilized used equipment. The study included the raw grinding, pyroprocess system, and the cement mill system.

### **1.2.19 Plant Expansion**

Turnell Corp's personnel provided engineering services for preliminary engineering of an expansion of a wet process cement plant from 1500 tpd to 2100 tpd. Modifications included the installation of a new vertical roller mill for raw grinding, conversion of a wet process kiln system to dry process system with 4-stage preheater and calciner, a new clinker cooler within the existing clinker

cooler box, a new main fabric filter, reused of the existing coal mill system, and the conversion of a wet ball mill to pre-grinder finish mill. The picture below shows the system installed.



## **1.3 Lime Plant Projects**

### **1.3.1 Glycerin Fuel System**

Turnell Corp completed a feasibility study for a glycerin fuel system. The scope of work included developing the system from glycerin receiving through to the burner. Tasks included developing the process flow diagram, equipment list, general layout drawings, and capital cost estimate.

### **1.3.2 Green Field Vertical Lime Kiln**

Turnell Corp's personnel provided engineering services for a new green field vertical lime kiln located at approximately 13,000 ft above sea level (4,000 meters above sea level). The plant consisted of the following: a crushing and screening system; a vertical, double shaft, regenerative kiln system; a lime crusher; lime storage bins, truck loadout systems, and liquid fuel storage and firing system.

### **1.3.3 Production Increase of a Rotary Lime Kiln**

Turnell Corp's personnel provided engineering services for the production increase of a rotary lime kiln that uses sea shells as the raw material. Modifications include the following: improvements to the sea shell washing systems, installation of a new kiln burner pipe, increasing the opening between the rotary cooler, installation of lifters in the kiln and rotary cooler, installation of a variable speed drive on the rotary cooler, the installation of a fabric filter to replace the existing cyclones on the kiln exhaust system, installation of a new kiln vent fan, and various other material handling modifications.

### **1.3.4 Feasibility Study for a New Green Field Lime Plant**

Turnell Corp's personnel provided engineering services for the completion of a feasibility study that included preliminary engineering to define the plant, determination of operating costs and capital costs, and assistance in preparing the return on investment calculations. This study also included assistance in preparing documents that were used to obtain project financing.

### **1.3.5 Indirect Coal Firing System for a Rotary Lime Kiln**

Turnell Corp's personnel provided engineering services for the completion of preliminary engineering of an indirect coal firing system for a rotary lime kiln that utilizes a refurbished ball mill. This system uses kiln exhaust gases as a source of heat to dry the coal.

### **1.3.6 Plant Upgrade of a Rotary Lime Kiln**

Turnell Corp's personnel provided engineering services to eliminate production bottlenecks caused by the existing water spray system and electrostatic precipitator (EP). The water spray system was replaced with a gas conditioning tower, the EP was converted to a fabric filter and the kiln vent fan was replaced with one designed for the new operating conditions.

### **1.3.7 Plant Upgrade of a Rotary Lime Kiln**

Turnell Corp's personnel provided engineering services for the production increase of a rotary lime kiln. Modifications included the installation of metallic and refractory three-foils, modifications to the kiln drive, and upgrade of the kiln exhaust system.

### **1.3.8 Indirect Coal Firing System for Two Vertical Lime Kilns**

Turnell Corp's personnel provided engineering services and equipment selection for the indirect coal firing system for two vertical kilns, including pulverizing, distribution and storage.

### **1.3.9 Plant Audit of a Kiln System to Maximize Capacity**

Turnell Corp's personnel provided engineering services for a plant audit that included a dimensional analysis of the kiln and the shaft cooler, analysis of the kiln rotational speed and motor power and a determination of the capacity requirements of the kiln vent gas water spray system, dust collection system, cooler fans, kiln vent fans and kiln burner.

### **1.3.10 Environmental BACT Analysis for Three Lime Kilns**

Turnell Corp's personnel provided engineering services for the preparation of a BACT analysis for three lime kilns. Pollutants considered in the analysis were PM, NO<sub>x</sub>, SO<sub>2</sub>, and CO.

### **1.3.11 Environmental Permit Application**

Turnell Corp's personnel provided engineering services for the preparation of a Permit Application (Prevention of Significant Air Quality Deterioration – PSD) for a lime kiln. Prepared data from other emission sources for inclusion in ISC3 air quality model.

### **1.3.12 Environmental Impact Assessment (EIA)**

Turnell Corp's personnel provided engineering services for the preparation of an Environmental Impact Assessment (EIA) for a greenfield lime plant. This assessment included a baseline study of PM and SO<sub>2</sub>, and dispersion modeling of the emission sources. Emission rates were based on the equipment design criteria and the AP-42 document published by the USA Environmental Protection Agency (EPA).