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A REVIEW OF ENVIRONMENTAL CONCERNS

Kaolin Clay Mining and Processing



Minnesota Department of Natural Resources
Division of Minerals
Reclamation Section

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A REVIEW OF ENVIRONMENTAL CONCERNS Kaolin Clay Mining and Processing

Reclamation Report Series 1989 - 2

July 1989

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A Legislative Commission on Natural Resources Project

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INTRODUCTION

In 1987, the Legislative Commission on Minnesota Resources funded a project to examine the economic potential of the kaolin clay resource in Minnesota. Four state agencies were identified to research various aspects of the project. The Minerals Division of the Minnesota Department of Natural Resources was responsible for: 1) the subject of this report, the review of potential environmental impacts associated with kaolin clay mining and processing, specifically for paper grade kaolin; and 2) market conditions, the subject of another report entitled "Market and Economic Considerations of Kaolin Clay."

One of the major project activities for the Minerals Division was a tour of the clay mining regions of Georgia and South Carolina where the paper grade kaolin industry is currently focused. At present, Minnesota has no paper grade kaolin mining. For this reason, a tour of the existing industry was an appropriate starting point for the project and one of its most informative aspects.

The tour began with an overview of environmental regulations hosted by the Georgia Department of Natural Resources. The meeting was followed by site visits to six kaolin clay mining operations in the Sandersville, Georgia area. Another meeting was conducted with the South Carolina Land Resources Conservation Commission to discuss their regulatory program. Several brick clay operations and a reclaimed clay pit in South Carolina were observed.

Other project activities included site visits to existing kaolin operations in Minnesota; compilation of applicable environmental permits for new and existing operations; preparation of a manual on permitting and environmental review procedures; and presentations at two public meetings on the environmental impacts of kaolin clay mining in the Minnesota River Valley.

This report summarizes in general terms the potential environmental concerns associated with the mining and processing of paper grade kaolin in the vicinity of the Minnesota River Valley including recommendations as to the adequacy of existing regulations. It begins with background information on kaolin clay in Georgia and South Carolina including formation, production statistics, mining and processing methods, and environmental regulations. A discussion follows on the Minnesota kaolin clay industry with a review of environmental regulations that would apply to the development of a paper grade kaolin mine. ♦

ORIGIN of KAOLIN CLAY

The term "kaolin" refers to a group of hydrous aluminum silicates, of which kaolinite is the predominate mineral. Kaolin is valued for a variety of physical properties including whiteness, nonabrasiveness, and inertness. Kaolin also has a fine particle size and is free-flowing in a dispersed state.

Kaolin is found as a residual or transported clay, known as primary and secondary deposits, respectively. Residual clays are the result of weathering of certain rocks, particularly granite. Transported clays result when clay minerals are physically translocated by water or wind and re-deposited.

There are five regions throughout the world that have significant deposits of coating grade kaolin. These regions are south Georgia in the United States; Cornwall, England; USSR; Brazil; and Australia.

Kaolin formation began in Georgia 70 million years ago through erosion of the weathered, crystalline rocks of the Piedmont Plateau. The weathering of these rocks (primarily mica and feldspar) occurred during the Cretaceous Period when the Atlantic Ocean covered much of what is now central Georgia. During this period, rivers and streams flowed from the mountains in the north, depositing thick layers of sediment along the Cretaceous shoreline, known as the "fall line". These sediments formed numerous deltas and alluvial fans. As the ocean level declined, the deltas and alluvial fans were exposed to subsequent weathering.

Extensive rainfall during the period which followed caused significant leaching and chemical alteration of the sediments, creating vast beds of kaolinite crystals. When the oceans advanced again during the Eocene Epoch, marine sediments were deposited on top of the kaolin. The kaolin clay belt in Georgia and South Carolina is an example of a transported clay or secondary deposit.

Minnesota has both primary and secondary kaolin deposits. Primary deposits occur in southwestern Minnesota but are often covered by glacial drift to depths of 50 to 250 feet. Outcrops of primary or residual clay deposits have been observed at various locations in the Minnesota River Valley.

Secondary kaolin clays were deposited in Minnesota by Cretaceous seas where they became buried by other sediments and eventually hardened to shales. The Cretaceous shales and clays are scattered from Brown to Goodhue Counties. ♦

KAOLIN PRODUCTION in GEORGIA and SOUTH CAROLINA

Georgia is the largest producer of kaolin in the world with about 60% of the free world market. Georgia kaolin is used primarily in the manufacture of high-grade paper as a filler or coating. The industry produced 7.9 million tons of kaolin in 1988 for a return of \$776 million dollars. In Georgia the industry is dominated by 11 companies that operate out of 26 mines. Currently, the industry is operating at capacity although many companies have plans for expansion.

South Carolina ranks second nationally in kaolin clay with production figures of 823,000 tons in 1988 at a value of 34 million dollars. The industry is focused near the town of Aiken which is on the eastern edge of the fall line. In South Carolina there are approximately 14 mines operated by 5 companies. Table 1 contains production figures for Georgia and South Carolina for the years 1985 to 1988. Note that Georgia clearly dominates in kaolin clay production in terms of both production and value. ♦

Table 1. Kaolin Clay Production Figures for Georgia and South Carolina from 1985 - 1988*

State	1985		1986		1987		1988 ^P	
	Tons	Value	Tons	Value	Tons	Value	Tons	Value
Georgia	6.35	535	6.78	635	7.42	714	7.90	776
South Carolina	.87	35	1.06	36	.81	36	.82	34

* Production figures reported in millions of short tons, value reported in millions of dollars.

^P Preliminary figures, Source: U.S. Bureau of Mines.

EXPLORATION METHODS

Kaolin deposits are initially located by drilling a series of drill holes up to several hundred feet deep. Core samples are extracted from the drill holes and sent to a laboratory for analysis to determine the character and tonnage of kaolin in the deposit. All of the large Georgia kaolin companies have active exploration programs. One company reports drilling over 1,850 drill holes a year with a total annual drill core length exceeding 165,000 feet

Kaolin reserves are obtained either by mineral leasing or land purchase option from private landowners. If sufficient kaolin of commercial grade is located to justify retention of the property, initial drilling is conducted on a grid of approximately one drill hole every five acres. This is followed by more closely spaced drilling to delineate principal areas of interest, or to more fully evaluate highly variable deposits. Prior to the opening of a mine, mine control drilling is completed on a grid of 200-foot centers, 100-foot centers, and finally 50-foot centers to accurately locate the commercial deposit. Cores recovered from these drill holes undergo detailed testing in the laboratory. Exploratory drilling, followed by mine control drilling and laboratory evaluation, requires a considerable monetary expenditure prior to the development of a kaolin mine. ♦

MINING METHODS

When the decision has been reached to open a kaolin mine in Georgia, applications for various environmental permits are made. Upon approval of a mine plan by the permitting authorities, overburden is removed using scrapers, bulldozers, and sometimes draglines, which deposit the material in stockpiles for future land reclamation. In Georgia, the overburden, consisting of unconsolidated clay, sand, and in some cases limestone, can be as much as 100 feet thick but is normally very thin over the kaolin deposits. Stripping ratios range from 2:1 to 7:1. Blasting is generally not necessary.

The crude kaolin is mined by mechanical loaders and transferred to dump trucks for transport to crude storage areas where it is held until it is needed for processing. The mines are usually open pit with strip mining methods used on larger pits. Pit depths range from 30 to 180 feet. The mining companies generally have several mine sites which vary in quality and characteristics. The crude kaolin from each mine site is stored until a particular grade of feed for the plant is required. Computers calculate the proportion of each crude necessary to meet customer specifications. ♦

PROCESSING METHODS

The objective of kaolin processing is the purification of kaolinite by removing impurities present in the crude; most notably sand, mica, iron compounds, and titanium oxides. Two methods are commonly used for processing crude kaolin: 1) the air flotation process which removes grit and coarse size particles; and 2) the waterwash process which removes finer-size impurities. A third process, calcination, further refines the clay by removing the chemically-bound water of hydroxylation. Processing methods vary by company and are generally described below.

Table 2 contains production figures on kaolin sold in the U. S. by kind. Note that waterwashed kaolin clays dominate in both value and production. The highest value product is calcined clay and its use is clearly increasing.

Table 2. Kaolin sold in the United States, by kind from 1985 to 1987.*

Kind of Clay	1985		1986		1987	
	Tons	Value	Tons	Value	Tons	Value
Air float	1.3	66	1.5	78	1.6	74
Calcined	1.1	116	1.2	167	1.2	203
Unprocessed	.9	14	1.1	15	.7	15
Water-washed	3.8	327	3.9	380	4.3	380

* Production figures reported in millions of short tons, value reported in millions of dollars.
Source: U.S. Bureau of Mines.

Air Flotation Process

Air flotation is primarily used for the production of filler clays. The process consists principally of crushing, drying, and pulverizing the crude ore, and then removing the impurities and oversized particles. This process does not require water. The primary waste products are the impurities removed from the clay. These may have a secondary use but most often the waste products are hauled back to the mine site for in-mine disposal or are landfilled. The air flotation process is much less capital-intensive than the waterwash process. It requires higher grade resources (minimum kaolin brightness of 80-81 with a maximum grit content of 5-6%). In Georgia, producers report that the price of air float kaolin varies depending on the quality but can be as low as \$40.00/ton F.O.B. the plant.

Waterwash Process

The technically more complex waterwash process is used primarily for production of high grade filler and coating clays by removing chemical contaminants such as iron oxides which stain the clay. Often the crude kaolin is of lesser quality than that used in the air float process (grit content as high as 30% is acceptable). The waterwash process is water-intensive. One Georgia company reports using 6 million gallons of water/day for processing. Water can be recycled back to the processing plants but most companies choose not to recycle because of residual salts which collect in the wastewater. Consequently, great volumes of wastewater must be treated and discharged.

The initial step in the waterwash process is to disperse the clay in a clay-water suspension to remove trace impurities. The crude clay, which normally contains 22 percent moisture, is mixed with water and dispersant and subjected to shear. This operation is commonly called blunging. The blunged kaolin is diluted and then degritted by passing it through a sandbox to remove coarse particles such as sand and mica. After degritting, the clay is ready for beneficiation.

In the industry, beneficiation refers to removal of fine particle size impurities from kaolin that remain even after degritting. The two impurities removed by beneficiation are iron and titanium compounds, both of which are detrimental to brightness.

Beneficiation methods can include froth flotation and magnetic separation. In froth flotation, chemicals that reduce surface tension are added to the kaolin; air is then forced into the liquid slurry, creating a froth. Impurities like iron and titanium oxides attach to the surface of the air bubbles to rise as a froth. As the froth is skimmed off, the impurities are removed.

In many cases, magnetic separation is used to further beneficiate the kaolin. The kaolin is passed through a very intense magnetic field which attract the iron oxide impurities.

The kaolin is then chemically leached to further improve its brightness. Leaching causes certain iron impurities to change in color and chemical composition so that they dissolve in water and may be washed out of the kaolin.

After leaching is completed, the kaolin is sent to large rotary vacuum filters, which remove the water from the clay. The kaolin is removed in the form of a thin cake at 60 percent solids. As the filter cake comes off the roll, it is

immediately dispersed and is then processed to form a high solids slurry or dried in a spray drier.

Spray drying is carried out in a large inverted conical chamber. Hot air enters the lower end of the cone and kaolin is pumped into the upper end where it hits a revolving plate and fine spray droplets are formed. As these droplets descend, they are dried and become fine beads of about 300-500 micrometer diameter. A rotary valve in the base of the spray dryer removes the product. The hot air, after filtration, passes into the atmosphere. Most spray-dried clay has a moisture content of less than 1 percent.

Calcination Process

Calcination is a relatively new process that further refines the clay by driving off the water contained within the crystalline lattice of the clay particles. The process involves an endothermic reaction during which the water of hydroxylation (about 14 percent of the kaolin) is driven off at a temperature of 500-700°C.

The calcining process is conducted in a specialized plant. Specially selected crude kaolin is processed through several steps, including blunging, degritting, washing, drying. The dried calcine clay feed is fed at a controlled rate into the top of a multi-hearth calciner kiln. The clay is added to the top of the first hearth, where rakes move the clay across the hearth and it drops to the second hearth. This process is repeated through several hearths until the final product is discharged at the bottom of the kiln. It is cooled and conveyed to silos for storage.

Calcination results in a high quality kaolin that producers report may sell for as much as \$400/ton, F.O.B. the plant. The calcination process produces a more opaque clay particle. Paper coated with calcined clay can be thinner yet not allow the print to show through to the other side of the paper. ♦

GEORGIA ENVIRONMENTAL REGULATIONS

Surface Mining Permit

Since 1969, the Land Resources and Sedimentation Program within the Georgia Department of Natural Resources has had regulatory authority for kaolin clay mining operations through the Georgia Surface Mining Act of 1968. The purpose of the Act is to 1) protect state waters and adjacent lands from effects of erosion and siltation from surface mining activities; and 2) provide for timely reclamation of all affected lands upon completion of the surface mining activity. Kaolin clay is one of several commodities including sand and gravel, crushed stone, fill material, brick clay, fullers earth, barite, mica, and peat regulated under the Act. Major provisions in the Act are: 1) promulgation of rules and regulations; 2) permitting authority; 3) mined land use plans; 4) bonding; and 5) compliance.

The Act was amended in 1985. Amendments included provisions for change in ownership, revision of the bonding requirement, and the establishment of a maximum bond of \$2,500/acre and a minimum of \$1,000/acre.

Since 1969, a total of 869 permits have been issued by the Georgia DNR for surface mining activity. In 1988, the Georgia DNR recorded 428 permits issued to active operations, 26 issued to operations in inactive status, and 39 in various stages of reclamation for a total of 493 permits. Of these, 136 have been issued to kaolin operations. Table 3 contains a distribution of the number of surface mining permits issued in Georgia by mineral for the year 1988.

Table 3. Surface Mining Permits Issued in Georgia in 1988.

<u>Mineral</u>	<u>Number of Permits</u>	<u>% of Total</u>
Sand/Gravel	154	31
Kaolin	136	28
Crushed Stone	77	15
Fill Material	58	12
Brick Clays	15	3
Fullers Earth	10	2
Other	4	9
TOTAL	493	100

All kaolin clay operators in Georgia must obtain a surface mining permit. Operators are required to reclaim all lands disturbed since 1969. Lands disturbed prior to 1969 are termed "pre-law lands" and are as such beyond the jurisdiction of the law. However, nearly all the kaolin companies have agreed to voluntarily reclaim their pre-law lands.

The surface mining permit is issued for the life of the operation. It includes information regarding: 1) company structure; 2) lands that will be affected by the mining operation; 3) mining methods; 4) mining schedule; 5) reclamation schedule; 6) erosion/sedimentation plan; 7) mine drainage plan/water holding facilities; and 8) estimated reclamation costs. The administrative time required for processing a complete application is 90 days.

Progressive reclamation is a concept that is actively promoted by the regulatory agencies. It is the process of actively reclaiming mining areas as soon as they are abandoned as opposed to reclaiming at the end of operations. Progressive reclamation reduces unnecessary material handling, allows reclamation to start initially with mining and decreases the amount of the reclamation bond.

Bonds, as a form of financial assurance, are required but may be waived if the company has demonstrated adequate reclamation. The only instances where bonds have been waived in Georgia have been for kaolin companies. The administrative time required for processing a complete application is 90 days.

Reclamation of Stockpiles and Open Pits

Kaolin operators generally do not have large volumes of overburden to stockpile and reclaim because the overburden is relatively thin. Georgia requires a final slope of 3:1 for all reclaimed stockpiles and the high walls of open pits. In the past, erosion and mass movement of material has occurred in these areas. Stockpiles and the high walls of open pits must also be vegetated with various species of perennial grasses selected for their soil-building characteristics. Seeding and grading is 75% of the cost of reclamation with grading taking up the bulk of the cost. Reclamation costs range from \$2,000 to \$3,000 per acre.

Vegetation establishment on the normally nutrient-poor soils associated with kaolin sites often requires the use of a nitrogen fixer. *Lespedeza* spp. (a clover) is commonly used for this purpose. Conifers, particularly loblolly pine, (*pinus taeda*) are used frequently for reforestation because they are well suited to the potentially harsh conditions of the reclaimed areas.

Vegetation establishment is usually achieved within two growing seasons and is generally successful.

Occasionally, "hot spots" develop on the surface of reclaimed areas where sulfur-bearing mineralization is exposed to oxidation. The resulting low pH makes revegetation difficult. In some cases, precipitation causes leaching of the low pH material downslope. The hot spots are usually a few feet in diameter and apparently pose no serious problem. They can be repaired through remedial efforts by re-application of overburden material and revegetating.

Several deactivated kaolin mine pits have been reclaimed as permanent open water areas. These areas have been designed for recreational purposes and for wildlife habitat. In several cases, shorelines have been graded to more gradual slopes to allow ease of access. These open water areas are popular with local residents as this area of Georgia has few natural lakes.

Water Quality at the Mine Site

Kaolin operators in Georgia must obtain a National Pollutants Discharge Elimination System (NPDES) permit through the DNR Water Resources Division if there is a direct discharge of water from the mine site. The emphasis of the NPDES permit is on water quality. For kaolin operations, suspended solids and pH are of primary concern. Operators are required to contain all runoff from the mine site in order to control suspended solids release to receiving waters. Settling basins designed for a 25 year rain event, (6 inches in a 24 hour period for south Georgia) are required on the mine site. Flocculation of suspended solids in the settling basins is sometimes performed by the addition of polymers, alum, and in some cases acid. Operators must also meet receiving water pH to discharge from the settling basin. However, pH has not been of major concern because of the inert nature of the kaolin. Mandatory monitoring of surface water and groundwater quality is the responsibility of the operator.

Permits Needed for Processing Facility

Processing plants that use the waterwash process for beneficiating kaolin clay often discharge wastewater from the plant to a tailings basin. The wastewater may have a pH as low as 3.0 due to the addition of acids during clay processing. The wastewater may also have a high suspended solid load. Kaolin operators must obtain an NPDES Permit to discharge water from a tailings basin to receiving waters. Wastewater treatment prior to discharge is necessary to meet suspended solid and pH standards. Treatment usually involves discharge of wastewater to a tailings basin where suspended solids

are allowed to settle out by gravity or by flocculation. Water must be treated to bring the pH up to the range of 6.0 - 9.0 before it can be discharged to receiving waters. Processing methods vary among companies as do the characteristics of the wastewater. Other water quality standards may apply.

In the air flotation process, the primary environmental concern is with the dust generated in the plant during processing. Air flotation plants generally must comply with air emission standards and may be required to obtain an air emissions permit. Wastewater discharge is not a consideration since this processing technique uses no water.

Environmental Review

Environmental review of new kaolin projects or proposed amendments to existing operations is also handled by the Georgia DNR. To date, an Environmental Impact Statement has not been required for any kaolin operation.

Federal Permits

A Section 404 Permit from the Army Corps of Engineers under authority of the Federal Clean Water Act has been required of some kaolin operators in Georgia that discharge dredged or fill material into Waters of the U.S. Waters of the U.S. has been defined to include type 1 - 8 wetlands (Cowardin Wetland Classification, circular 39). ♦

SOUTH CAROLINA ENVIRONMENTAL REGULATIONS

Surface Mining Permit

Since 1974, the Division of Mining and Reclamation within the South Carolina Land Resources Conservation Commission has had authority for administering and implementing the South Carolina Mining Act. The Mining Act provides: "That the usefulness, productivity, and scenic values of all lands and waters involved in mining within the State will receive the greatest practical degree of protection and restoration," and "That from the effective date of the Act, no mining shall be carried on in the State unless plans for such mining include reasonable provisions for protection of the surrounding environment and for reclamation of the area of land affected by mining." Enforcement of the Act is through the approval of reclamation plans, issuance of mining permits, collection of reclamation bonds and periodic inspections of mining operations. Reclamation rules were promulgated under the Act in 1980.

The South Carolina Mining Act is similar to Georgia's in that it regulates all surface mining activity. Kaolin is one of several commodities that are covered by the Act. The Division of Mining and Reclamation has 485 active permits on file, the majority of which are for sand and gravel operations.

Mining permits are issued for a maximum of 10 years and are then subject to reevaluation. The contents of the permit are similar to the Georgia surface mining permit. The administrative time required to process a non-controversial permit is 60 days. A controversial permit may involve public hearings and could take 8-12 months. The permits issued for kaolin operations have all been non-controversial with one exception.

The Mining Act requires a reclamation bond, the amount of which depends on the number of acres being mined (Table 4).

Table 4. Bonding Requirements Imposed in South Carolina

Acres being Mined	Amount of Bond (\$)
0-5	2,500
5-10	5,000
11-24	12,500
25	25,000
> 25	25,000

Like Georgia, progressive reclamation is strongly emphasized since it is both environmentally acceptable and cost effective. Sloping and vegetation requirements are similar to those enforced in Georgia. The mining permit requires that a mining company define at the time of permit application their plans for final reclamation.

The Health and Environmental Control Division of the State Department of Health administers NPDES permits. Settling basins have been required through NPDES discharge permits for all kaolin clay mine sites. South Carolina has only one waterwash plant and it has an NPDES permit that requires wastewater treatment prior to discharge. ♦

KAOLIN INDUSTRY in MINNESOTA

Existing Operations

In 1988, there were three active kaolin clay operations in Minnesota, all located in the Minnesota River Valley. Two of these are found in Redwood County (Northwestern Portland Cement Corporation and Nova Natural Resources Corporation); the other is in Brown County (Northern Con-Agg, Inc.). The kaolin mined from these operations is used exclusively in the manufacture of cement. In all cases, the crude kaolin is shipped by rail or truck to cement processing plants in Mason City, Iowa.

In addition to the three operations in the Minnesota River Valley, Ochs Brick Company, located near Springfield in Brown County, operates 2 pits containing kaolin clay. Their primary clay pit, which has been in operation for over a hundred years, is about one mile from Springfield. The company mines clay from this pit for two weeks a year to supply the feed for a newly renovated brick manufacturing plant located in Springfield. Ochs mines clay from another pit near Redwood Falls which is used only occasionally. The company's primary interest in kaolin is for the color it imparts to the bricks. Figure 1 contains the locations of known kaolin clay pits in Minnesota. Other clay pits may be used locally for pottery or brick production, however, discussion of these pits is not applicable to this report.

Northwestern Portland Cement Corporation of Mason City, Iowa received a conditional land use permit to mine kaolin clay from Redwood County on June 11, 1985. The permit covers 25.5 acres. According to the permit, the anticipated life of the operation is 6 to 8 years. Mining is conducted using bulldozers and frontend loaders. Nearly 100% of the crude kaolin is transported by rail to Mason City for processing. Mining is conducted seasonally at a rate of seven 100-ton rail cars per day over a five-day work week. The permit requires a \$20,000 bond for reclamation in the event the company defaults on reclamation obligations. The permit also requires that buffer strips comprised of trees and original vegetation be left in place to screen the operation. Banks must be sloped to minimize erosion and promote safety. A 100 foot setback must be maintained between the mining operation and private property.

Nova Natural Resources Corporation of Salt Lake City, Utah received a conditional land use permit to mine kaolin clay from Redwood County on May 5, 1988. The permit covers 9.3 acres. The mine site is located adjacent to the Northwestern Portland Cement operation. Approximately 90% of the crude kaolin is to be shipped by rail to Iowa, the remainder will be

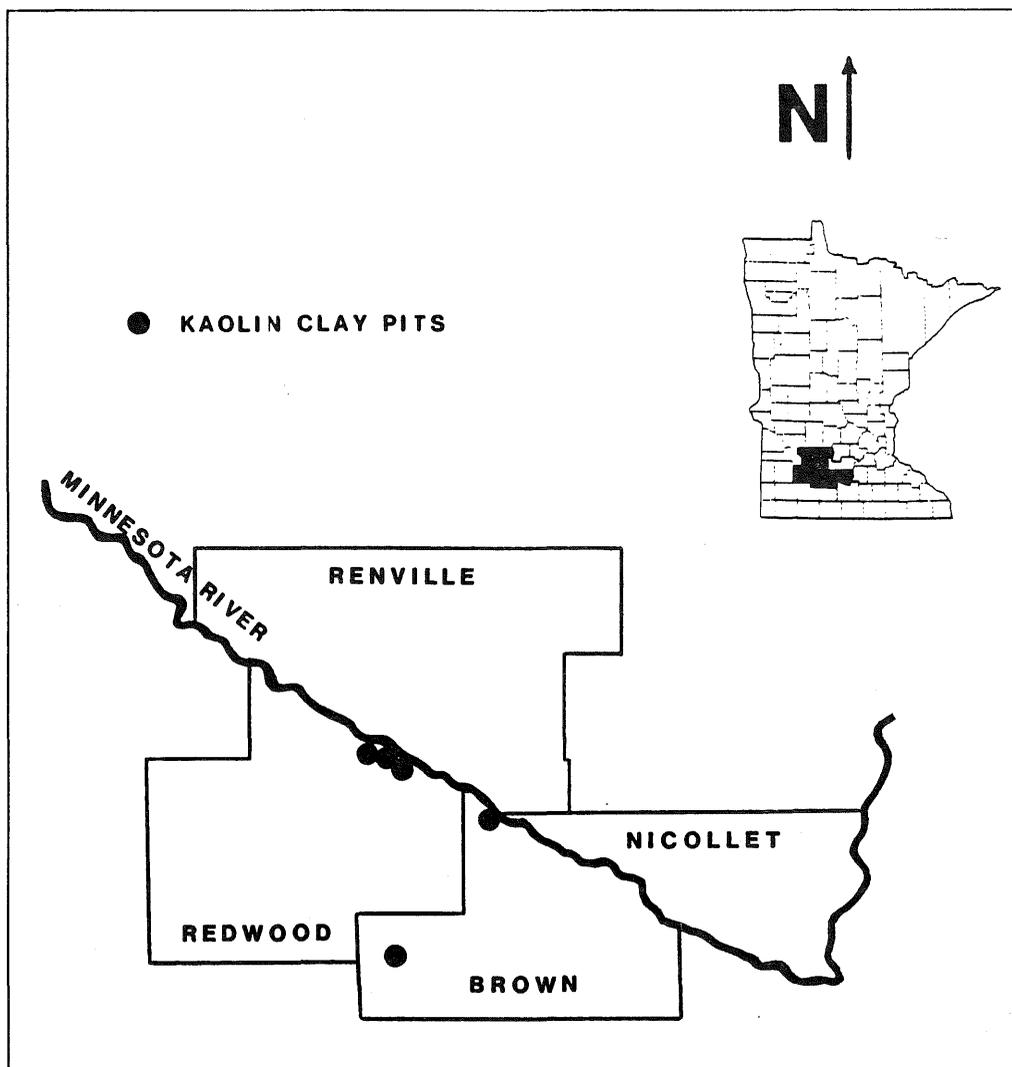


Figure 1. Location of Kaolin Clay Pits in Minnesota.

trucked. The county required a \$50,000 bond for reclamation purposes. Other terms of the permit include: 1) restricted hours of operation from 6AM to 6PM, Monday through Friday; 2) banks must be sloped to avoid slumping; 3) heavy equipment must be equipped with noise reduction devices; and 4) a settling basin to contain runoff water must be constructed.

Northern Con-Agg, Inc. applied for a conditional land use permit from Brown County on April 18, 1988. The permit was granted with the following provisions: 1) submittal of a \$10,000 performance bond for reclamation; 2) a 50 foot setback from a county road right-of-way must be maintained; 3) surface water must be controlled; and 4) the operator must cooperate with regional DNR staff regarding concerns about berms and wildlife habitat

establishment. The projected life of the operation is 15 years. The permit is valid for three years and is then subject to renewal. The permitted area is approximately 70 acres within a 240 acre parcel leased by Northern Con-Agg from a private landowner. However, the actual mining area is about 25 - 30 acres, with less than an acre being developed in 1988. Final reclamation calls for the creation of a 22-acre open water basin. The crude kaolin is to be trucked to the town of Sleepyeye where it will be loaded onto rail cars for transport to a processing facility in Iowa.

Environmental Concerns

Active Mining Issues. Common complaints regarding kaolin clay mining operations in the Minnesota River Valley center on the mine site. Active mining issues such as hours of operation, traffic, noise, dust, transportation routes, safety, and slumping of the bluff wall are addressed through local conditional land use permits (CLUP).

Water Quality. The quality of runoff water leaving the mine site has been a concern at the Northwestern Portland Cement and Nova Natural Resources mine sites. They have applied for a joint National Pollutant Discharge Elimination Permit (NPDES) and State Disposal System Permit (SDS) from the Minnesota Pollution Control Agency (MPCA). These permits are necessary if there is to be a direct discharge of water from the mine site. The purpose of the NPDES/SDS permits is to regulate the quality of discharge water to surface waters and ground water. The primary water quality issue with kaolin clay mining is suspended solids. The construction of a sedimentation basin for treatment of discharge water and regular monitoring of water quality discharged from the mine site are required by the NPDES permit. MPCA has determined that an NPDES permit is unnecessary at the Northern Con-Agg site because there will be no direct discharge.

Reclamation. Reclamation of these sites after mining has also been a concern. It should be noted that there are no state reclamation regulations for kaolin clay mining as there are for taconite, iron ore, and peat mining. Reclamation is currently addressed through the local conditional land use permit. In Redwood and Brown counties, the sites of active kaolin mining, the CLUP requires a reclamation plan at the time of permit application subject to approval by the county board. The reclamation plan includes details on reclamation of the mine site and auxiliary facilities, and schedules for mine development and closure. Progressive reclamation is emphasized in the CLUP. Reclamation bonds have been imposed on all three operations in the Minnesota River Valley. Bonding has been difficult for some

operators to obtain. In these instances, a letter of credit from a bank has been accepted in lieu of a bond.

Other questions have been raised by the public and local officials with respect to reclamation as follows:

- Does local government have the technical background to regulate kaolin clay mining?
- Is a state-administered reclamation program for kaolin clay mining necessary?
- Under what circumstances is financial assurance (including bonds and letters of credit) necessary and what is an appropriate amount?
- If post-mining management of a kaolin mine site is necessary, (long-term management of a tailing basin, for example), how will it be conducted and who is responsible?
- Finally, given the variability of county ordinances in terms of requirements and enforcement, can the CLUP accomplish uniform regulation of the clay mining industry?

Given the current size of the industry, officials in both Redwood and Brown Counties are satisfied with the reclamation plans submitted by the kaolin operators in their respective counties. ♦

MINING PAPER GRADE KAOLIN CLAY in MINNESOTA

A mine for paper grade kaolin in Minnesota would differ significantly from existing operations for several reasons. Based on limited resource evaluation, the potential paper grade kaolin resource appears to be more deeply buried than the resource currently being mined which would require a deeper mine and more overburden to stockpile. In addition, an economically viable paper grade kaolin mine would have to be larger than existing operations and include a processing plant facility. The environmental concerns associated with existing operations therefore, do not exactly mirror those associated with a paper grade kaolin mine.

Two drill core obtained through the Kaolin Clay Project, funded by the Legislative Commission on Minnesota Resources (LCMR) have generated interest among the kaolin mining industry. Both drill core are from Renville County near Fairfax. One core contains approximately 160 feet of overburden over 70 feet of secondary/primary kaolin. The other contains 78 feet of overburden over 160 + feet of primary kaolin. Initial testing of the kaolin in this deposit indicates that a recovery of approximately 35% paper grade kaolin is possible with extensive processing.

A hypothetical model for the first paper grade kaolin mine in Minnesota was developed by the Mineral Resources Research Center in conjunction with the LCMR Kaolin Clay Project. The scenario projects a mining area as large as 80 acres with auxiliary facilities including stockpiling areas, tailings basin and processing plant consuming another 80 acres or more. The life of the operation is expected to be about 20 years with production of 200,000 tons/year. Because the crude kaolin would require beneficiation, the scenario includes a sophisticated waterwash processing plant on or near to the mine site. Processing would be water intensive and wastewater would likely be associated with the plant. A tailings basin would probably be constructed to contain the wastewater and to serve as a treatment facility. Such an operation would be fairly modest in size compared to the operations in Georgia. ♦

EXPLORATION ACTIVITIES in MINNESOTA

The newly-generated interest in the kaolin clay resource in the vicinity of the Minnesota River Valley has triggered an increase in exploration activities such as exploratory drilling. Approximately 5 companies are actively exploring the kaolin resource in Minnesota, the majority of these being paper grade kaolin mining companies from Georgia. Several mining companies have negotiated leasing agreements with private land owners in the area for mineral rights. The nature of these agreements is variable.

The public has raised questions about exploratory drilling for kaolin clay as a possible source of groundwater contamination. Similar concerns regarding metallic mineral exploration resulted in the Water Wells and Exploratory Boring Law (Minnesota Statutes, 156A.01). This law requires companies conducting exploratory borings to obtain a license from the Minnesota Department of Health and register with the Minnesota Department of Natural Resources in order to conduct exploratory borings in the state. The law regulates the abandonment of drill holes. It requires that drill holes be properly sealed as part of abandonment. As a matter of practice, the kaolin exploration companies generally abandon drill holes in a manner, consistent with the requirements of the Water Wells and Exploratory Boring Law. ♦

ENVIRONMENTAL REVIEW in MINNESOTA

The Minnesota Environmental Policy Act of 1973 established a formal process for reviewing the environmental impacts of major development projects. The purpose of the review is to provide information on the environmental effects associated with a project to units of government, the public, and industry before necessary permits are issued.

The process operates according to rules adopted by the Environmental Quality Board (EQB). The EQB designates a local governmental unit or a state agency to conduct the actual review. This agency or local government unit is referred to as the Responsible Governmental Unit (RGU). Depending on the type and size of a project, the review can take the form of an Environmental Assessment Worksheet (EAW) or an Environmental Impact Statement (EIS).

The EAW is designed to rapidly assess the environmental effects that may be associated with a proposed project and to aid in the determination of whether an EIS is needed. Once the EAW is complete and available for review, there is a 30-day comment period. Within 15 days after the comment period, the responsible governmental agency must decide whether there is a need for an EIS. If no EIS is needed, the project can proceed to the permitting stage. If an EIS is needed, the EAW is used as a scoping document to identify the issues to be addressed in the EIS. Preparation of an EIS may take a year or longer while the preparation of an EAW may require as little as 3 months.

If environmental review is required, no development can proceed until the process is completed. Similarly, no permits can be issued until environmental review is complete, although permit negotiations can be conducted concurrently with the environmental review process. Both the environmental review and permitting processes have opportunities for public input through public notices and hearings.

The rules adopted by the EQB (Minnesota Rules, Chapter 4410) contain mandatory categories for both the EAW and the EIS. Recent amendments to the EQB rules (effective 12/27/88) require that multiple projects and multiple stages of a single project that are connected actions or phased actions must be considered in total when comparing the project or projects to the EAW and EIS thresholds.

Several categories may be applicable to kaolin clay mining and processing. These categories together with the designated RGU are listed below. A complete list of mandatory EAW and EIS categories is found in Minnesota Rules, Parts 4410.4300 and 4410.4400.

No environmental review of existing kaolin operations in Minnesota was conducted prior to mine development because in all cases the operations were less than 40 acres, the minimum size threshold for an EAW. The need for environmental review of kaolin clay mining projects that fall under minimum size thresholds has been raised. EQB rules provide for the preparation of a "Discretionary EAW" for projects that do not meet minimum thresholds.

The local unit of government is the RGU for kaolin clay mining projects. Concerns have been expressed about the technical ability of the counties to perform thorough environmental review. According to the EQB rules, the EQB may designate or an RGU may request assistance from a technical agency like the DNR in the preparation of an environmental review document. DNR is cited as the RGU for other mining projects.

Environmental Assessment Worksheet

The preparation of an EAW is mandatory for projects that meet or exceed one or more of the following thresholds:

- For development of a facility for the extraction or mining of sand, gravel, stone, or other nonmetallic minerals, other than peat, which will excavate 40 or more acres of land to a mean depth of ten feet or more during its existence. The local government unit shall be the RGU.
- For a new appropriation for commercial or industrial purposes of either surface water or groundwater averaging 30 million gallons per month. The Minnesota Department of Natural Resources (DNR) shall be the RGU.
- For a new or additional permanent impoundment of water creating a water surface of 160 or more acres. The DNR shall be the RGU.
- For the diversion or channelization a natural watercourse with a total watershed of ten or more square miles, or a designated trout stream, unless exempted by part 4410.4600, subp. 14, item E, or subp. 17 of the EQB rules. The local government unit shall be the RGU.

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- For projects that will change or diminish the course, current, or cross-section of one acre or more of any protected water or protected wetland except for those to be drained without a permit pursuant to Minnesota Statutes, section 105.391, subd. 3. The local government unit shall be the RGU.
 - For projects that will change or diminish the course, current, or cross-section of 40 percent or more or five or more acres of types 3 through 8 wetland of 2.5 acres or more, excluding protected wetlands, if any part of the wetland is within a shoreland area, delineated flood plain, a state or federally designated wild and scenic rivers district, the Minnesota River Project Riverbend area, or the Mississippi River headwaters area. The local government unit shall be the RGU.
 - For the construction of a stationary source facility that generates 100 tons or more per year of any single air pollutant after installation of air pollution control equipment. The Minnesota Pollution Control Agency (PCA) shall be the RGU.
 - For construction of a new or expansion of an existing industrial, commercial, or institutional facility of 20,000 or more square feet of ground area, if the local governmental unit has not adopted water-related land use management district ordinances or plans, as applicable, and either the project involves riparian frontage or 20,000 or more square feet of ground area to be developed is within a water-related land use management district. The local government unit shall be the RGU. However, this item only applies to shoreland areas, floodplains, and state wild and scenic rivers land use districts if the local unit of government has received official notice from the Department of Natural Resources that it must adopt applicable land use management district ordinances within a specified period of time.
 - For construction of a Class II dam. The DNR shall be the RGU.
 - For projects resulting in the permanent conversion of 80 or more acres of agricultural, forest, or naturally vegetated land to a more intensive, developed land use. The local government unit shall be the RGU.

Environmental Impact Statement

The preparation of an EIS is mandatory if a project meets or exceeds one of the following thresholds:

- For the development of a facility for the extraction or mining of sand, gravel, stone, or other nonmetallic minerals, other than peat, which

will excavate 160 acres of land or more to a mean depth of ten feet or more during its existence. The local government unit shall be the RGU.

- For the construction of a Class I dam. The DNR shall be the RGU.
- For projects that will eliminate a protected water or protected wetland except for those to be drained without a permit pursuant to Minnesota Statutes, section 105.391, subd. 3. The local government unit shall be the RGU.
- For construction of a new or expansion of an existing industrial, commercial, or institutional facility of 100,000 or more square feet of ground area, if the local governmental unit has not adopted water-related land use management district ordinances or plans, as applicable, and either the project involves riparian frontage or 100,000 or more square feet of ground area to be developed is within a water-related land use management district. The local government unit shall be the RGU. However, this item only applies to shoreland areas, floodplains, and state wild and scenic rivers land use districts if the local unit of government has received official notice from the Department of Natural Resources that it must adopt applicable land use management district ordinances within a specified period of time. ♦

ENVIRONMENTAL PERMITS in MINNESOTA

Environmental permits are issued after environmental review is complete. Many of the potential environmental concerns associated with the development of a paper grade kaolin mine are covered through one or more of these existing permits.

Mining operations cannot begin until all applicable permits have been issued. Some permits require 180 days to process. Most permits have provision for a public participation. The permits require specific information about the mining proposal including mining maps, plans, and operating schedules. Once a permit has been issued, all permitting authorities have regular reporting and monitoring requirements and the authority to evaluate compliance and enforce civil penalties if a company is found in violation of the terms of a permit. Listed below are the various permits and a brief discussion of the concerns the permit is intended to address. Appendix A contains a list of applicable federal, state, and local environmental permits and identifies a contact person for each permit.

Water Appropriation Permit

According to Minnesota Statutes 105.41 and Minnesota Rules, Parts 6115.0600 to 6115.0810, a Water Appropriation Permit issued by DNR is required for all forms of appropriation (withdrawal) from surface water or groundwater sources. For kaolin clay mining, appropriation might typically include: pit dewatering; makeup water needs; tailings basin excess water release; well water for domestic consumption; and road watering. Water uses requiring less than 10,000 gallons per day and totalling no more than 1,000,000 gallons per year normally do not require a permit.

National Pollutant Discharge Elimination System Permit

A National Pollutant Discharge Elimination System Permit (NPDES) issued by MPCA is required for the discharge of a pollutant into the waters of the state from a point source. A complete permit application should be submitted at least 180 days before beginning a point source discharge. Examples of point source discharges relevant to the kaolin industry include: pit dewatering; pumping or siphoning from a tailings basin; and runoff and/or seepage from mining wastes such as stockpiles. The statutory authority for the NPDES Permit is Minnesota Statutes, Chapters 115 & 116, and the federal Clean Water Act (33 U.S.C. 1251 et seq).

An NPDES permit would likely be required at both the mine site and the processing plant if a discharge is anticipated. At the mine site all surface water must be contained. At least one settling basin would probably be required to allow treatment of the discharge water leaving the site. Routine monitoring of groundwater, surface water, and discharge water would also be required. Discharge water must meet certain water quality standards before it can be released to receiving waters.

Stockpiles of mine waste (overburden material, lean ore, and waste rock, for example) are regarded as potential point sources of pollutants by the NPDES regulations. It is possible that characterization of materials to be stockpiled would be required through the NPDES permit.

An NPDES permit would also likely be required for the tailings basin associated with the processing plant. Full disclosure of the chemical reagents used in the processing of the kaolin would be necessary together with a characterization of the tailings and wastewater. Treatment and monitoring of discharge waters from the tailings basin would be required. A final closure plan for the basin would be a component in the permit.

State Disposal System Permit

An State Disposal System Permit (SDS), also issued by MPCA, is required for the construction, installation or operation of a disposal system. A complete permit application should be submitted at least 180 days before beginning construction of a disposal system. A disposal system is a system for disposing of sewage, industrial waste and other wastes, and includes sewer systems and treatment works. NPDES and SDS Permits are usually issued jointly. A tailings basin is an example of facility that would require an SDS permit.

Dam Safety Permit

According to Minnesota Rules 6115.0300 - 6115.0520, a Dam Safety Permit, issued by DNR, is required for any artificial barrier which does or may impound water, and/or waste materials containing water, which is greater than 6 feet high and has a maximum storage capacity greater than 15 acre-feet. This permit would apply to the tailings basin and dam. A discussion of closure plans and post-mining management of the basin would be part of the permit.

Air Emission Facility Permit

The MPCA administers Air Emission Facility Permits under the authority of both state and federal regulations (Minnesota Rules, Chapters 7001 &

7005 and the Code of Federal Regulations 40 CFR). The agency issues one permit for both the state and federal rules. This permit would apply to air emissions generated by the processing plant.

Conditional Land Use Permit

The Conditional Land Use Permit is the vehicle that Redwood, Brown, Nicollet, and Renville Counties would use to regulate kaolin clay mining and processing. The emphasis of the Conditional Land Use Permit for all counties is on reclamation and active mining concerns such as transportation, dust control, noise, blasting, and hours of operation. Bonding may also be imposed. Safety issues like fencing of the mining area could also be considered under the CLUP.

Mineland Reclamation Permit

The DNR, under authority of Minnesota Statutes 93.44-93.51, administers Mineland Reclamation Permits for taconite, iron ore, and peat mining operations (Minnesota Rules, chapters 6130 and 6131). Reclamation of other types of mining operations (sand and gravel, clay, dimension stone, for example) is regulated at the county level. Although there is presently no state reclamation program for kaolin clay mining, there may be at some future date if there is a significant expansion of the industry. ♦

OTHER APPLICABLE PERMITS

In addition to the previously listed permits, if a proposed kaolin clay project will impact a protected waters, a wetland, or a navigable water of the United States, the following permits will apply.

Work in the Beds of Protected Waters Permit

According to Minnesota Statutes 105.42 & 105.64 and Minnesota Rules 6115.0150 - 6115.0272, a Protected Waters Permit issued by DNR is required when physical changes in the course, current, or cross-section of protected waters, whether by filling, excavating, draining, or placement of structures such as dams, bridges, or culverts are contemplated. Protected waters have been defined through an extensive, statewide inventory. County maps highlighting protected waters are available from the DNR-Division of Waters.

Section 404 Permit

A Section 404 Permit is required under the authority of the Federal Clean Water Act (33 U.S.C. 1344). Any discharge of dredged or fill material into Waters of the United States requires Army Corps of Engineers approval through the Section 404 Permit. "Waters of the U.S." has been defined by the courts to include wetlands. The Corps regulates all wetland types (Types 1 to 8, Cowardin Wetland Classification System, U.S.F.W.S. Circular 39).

Section 10 Permit

A Section 10 Permit is required under the authority of the Federal Rivers and Harbors Act of 1899 (33 U.S.C. 403). Any work in, under, over, or affecting the course, condition, or capacity of a Navigable Water of the United States requires Army Corps of Engineers approval through the Section 10 Permit. The Minnesota River, among others in the state, is regarded as a Navigable Water of the United States. ♦

REGIONAL LAND USES

The recent development of three kaolin clay mining operations near the Minnesota River has sparked debate over the appropriateness of additional mining activities within the bluff line of the Minnesota River Valley. Three state laws that have applicability to the Minnesota River Valley are discussed below. These laws require local government to adopt zoning ordinances that meet statewide minimum standards. For shorelands, floodplains, and lands adjacent to rivers designated by the state as wild and scenic, the DNR has the authority to set these standards and to review local ordinances for compliance.

According to existing land use ordinances, kaolin clay mining is a legitimate land use on the lands currently under permit. The question of whether to allow additional mining within the bluff line of the Minnesota River Valley is a land use issue that is beyond the scope of this report.

Shoreland Management Act

The Shoreland Management Act authorizes the DNR to classify the shorelands of the state according to intensity of development and then to establish minimum statewide zoning standards to aid municipalities in regulating use of the land. The act requires each county or municipality to adopt local shoreland zoning ordinances that comply with the minimum standards (Minnesota Statutes 105.485, subd. 6 and Minnesota Rules, Part 6120.2500). The DNR reviews each local ordinance to insure compliance with the statewide standards. Local ordinances may be stricter than DNR standards but may not be more lenient.

Land within 1,000 feet of the ordinary high water level of a protected water basin, or within 300 feet of a protected watercourse, is subject to the minimum standards authorized in the Shoreland Management Act (Minnesota Statutes 105.485, subd. 2). These standards regulate land uses, lot sizes, structure placement, sanitary facilities, and changes of bottom contour of adjacent public waters (Minnesota Statutes 105.485, subd. 3).

Floodplain Management Act

The Floodplain Management Act controls development and construction on floodplains (Minnesota Statutes, Chapter 104 and Minnesota Rules, Part 6120.5000). The primary purpose of the Floodplain Management Act is to "manage the floodplains for beneficial uses compatible with the preservation of the capacity of the floodplain to carry and discharge the regional flood"

(Minnesota Statutes 104.03 subd. 1(d)). Like shorelands, floodplains are regulated by local zoning ordinances, which must comply with minimum standards established by the DNR. The DNR standards include specifications for acceptable construction, flood warning requirements, sanitary protection measures, and procedures for granting variances .

Wild and Scenic Rivers Act

The Minnesota Legislature has acted to preserve some rivers that provide unique natural settings of "outstanding scenic, recreational, natural, scientific and similar values" (Minnesota Statutes 104.31 and Minnesota Rules, Chapter 6105). Any portion of a river that is wild, scenic, or has important recreational value may be included in the program.

As with the Shoreland and Floodplain Management Acts, the Wild and Scenic Rivers Act requires local governments to develop zoning ordinances to preserve natural beauty, prevent pollution, minimize crowding, prohibit poorly planned or inappropriate development, and promote the general welfare of the public (Minnesota Rules, Part 6105.0080). These ordinances may vary from place to place, to meet local needs, but they all must meet DNR standards for the designated rivers and adjacent land (Minnesota Statutes 104.36). The regulations affect lot size and the number, placement, and design of structures (Minnesota Rules, Part 6105.0110). Utility transmission crossings, roads, and clearing of vegetation are also regulated (Minnesota Rules, Part 6105.0150).

Portions of the Minnesota River have been designated as a component of the Minnesota wild and scenic river system. That portion of the Minnesota River and adjacent lands from the Lac qui Parle dam to the U.S. Highway 212 bridge in the corporate limits of Montevideo is classified as scenic. That portion of the Minnesota River and adjacent lands from the U.S. Highway 212 bridge in the corporate limits of Montevideo to the Great Lakes Pipeline one-quarter mile downstream of the Minnesota Falls dam is classified as recreational. That portion of the Minnesota River and adjacent lands from the Great Lakes Pipeline one-quarter mile downstream of the Minnesota Falls dam to the Redwood County state aid highway 11 bridge is classified as scenic. The counties of Lac qui Parle, Chippewa, Yellow Medicine, Renville, and Redwood have enacted or amended ordinances to establish scenic and recreational river land use districts as applicable (Minnesota Rules, Parts 6105.1200 - 6105.1370). ♦

RECOMMENDATIONS

It is the conclusion of this report that the existing environmental review and permitting framework within Minnesota is adequate to identify and mitigate environmental concerns associated with kaolin clay mining at its present level of intensity. However, if a paper grade kaolin mining industry develops, or if there is a significant expansion of the current industry, changes should be considered in the following three aspects of the environmental review and permitting process.

Exploration Activities

Provisions of the Water Wells and Exploratory Boring Law apply only to metallic mineral exploration activities. Questions have been raised as to whether this law should be broadened to include more than metallic mineral explorers. Amendments have been proposed at various times to expand the scope of the law. However, to expand the law to industrial mineral exploration would require a substantial increase in appropriation for enforcement of licensing and registration requirements.

Environmental Review Process

In the environmental review process, the local unit of government is the RGU. Questions have been raised as to whether the county has the technical expertise to conduct a thorough EAW or EIS. In the event of a major kaolin proposal, it is possible that the DNR may be assigned by the EQB to assist in the preparation of an environmental review document. The DNR is the RGU on environmental review for other projects dealing with mining.

State Reclamation Rules

There are currently no state reclamation rules for kaolin clay mining. At this point, no rules are necessary because reclamation appears to be satisfactorily regulated through the conditional land use permit. If the paper grade industry develops as some predict, the need for state rules would have to be reevaluated. At present, the size and number of existing kaolin operations does not warrant a state program specific to kaolin clay. Finally, the DNR has gained substantial technical knowledge on kaolin clay mining as a result of the Kaolin Clay Project. The DNR is prepared to provide technical assistance to the public, state, and local regulatory agencies, and industry on kaolin mining as necessary and appropriate. ♦

APPENDIX A

Environmental Permits For Kaolin Clay Mining

ENVIRONMENTAL PERMITS

Appendix A lists applicable federal, state, and local environmental permits that may be required for kaolin clay mining and processing in the vicinity of the Minnesota River Valley. The agencies that may have regulatory authority for kaolin clay mining and processing and their respective permits are listed below in outline format and a contact person identified. For a given mining proposal, some of these permits may not apply. Similarly, some permits may be applicable that are not listed. The permits necessary for developing a kaolin mine and processing facility ultimately depend on a specific mining proposal.

Environmental Quality Board

Environmental Assessment Worksheet

Environmental Impact Statement

Gregg Downing
Environmental Quality Board
300 Centennial Building
658 Cedar Street
St. Paul, MN 55155
612/296-8253

United States Army Corps of Engineers

Section 404 Permit

Section 10 Permit

Paul Richert
U.S. Army Corps of Engineers
St. Paul District
1421 U.S. Post Office and Custom House
St. Paul, MN 55101-1479
Attn: CO-RF
612/220-0372

Minnesota Department of Natural Resources

Water Appropriation Permit

John Jaschke, Area Hydrologist
Minnesota Department of Natural Resources
Box 756, Highway 15 South
New Ulm, MN 56073
507/354-2196

Work in the Beds of Protected Waters Permit

John Jaschke, Area Hydrologist
Minnesota Department of Natural Resources
Box 756, Highway 15 South
New Ulm, MN 56073
507/354-2196

Dam Safety Permit

Craig Regalia, Dam Safety Supervisor
Minnesota Department of Natural Resources
Division of Waters
500 Lafayette Road
St. Paul, MN 55155-4032
612/296-0525

Minnesota Pollution Control Agency

National Pollutant Discharge Elimination System Permit

Jim Strudell
Minnesota Pollution Control Agency
Water Quality Division
520 Lafayette Road
St. Paul, MN 55155
612/296-7238

State Disposal System Permit

Jim Strudell
Minnesota Pollution Control Agency
Water Quality Division
520 Lafayette Road
St. Paul, MN 55155
612/296-7238

Air Emission Facility Permit

Ahto Niemioja, Permit Unit Supervisor
Minnesota Pollution Control Agency
Air Quality Control
520 Lafayette Road
St. Paul, MN 55155
612/296-7810

Local Units of Government

Conditional Land Use Permit

Larry Zupke
Renville County Zoning Administrator
Renville County Courthouse
500 East DePue Avenue
Olivia, MN 56277
612/523-2522

Gary Zick
Redwood County Zoning Administrator
Redwood County Courthouse
P. O. Box 4
Redwood Falls, MN 56283
507/637-2811

Chuck Enter
Brown County Zoning Administrator
Brown County Courthouse
Room 211
New Ulm, MN 56073
507/359-7900

Willard Johnson
Nicollet County Zoning Administrator
Nicollet County Courthouse
P. O. Box 27
St. Peter, MN 56082
507/931/6800

