Solution for Coal Ash

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Coal ash has become a very hot topic in the US and around the world. As power plants are running far past their intended life, the infrastructure designed to accommodate the plant tend to be overtaxed. In addition, requirements and technology have changed over the years necessitating more secure storage of landfill constituents.

Methods of dealing with the coal ash vary significantly from state to state and even plant to plant. It seems that any solution has drawbacks. Removal and shipping is costly and requires shipping over the roads, reuse likewise requires shipping, but not all ash can be used depending on size distribution, carbon content and location of the ash – fresh vs. landfill.

Nu-Rock Technology USA has a technology that has been used in Australia and in South Africa for over 25 years. This technology enables us to make superior building products out of coal ash. Unlike additives to concrete, our products use no concrete at all and utilize up to 95% ash.

Nu-Rock has used all types of ash, meaning fly ash, bottom ash, fresh from the operating plant and from the pond / landfill. We have used these ashes together and on their own with very good results. The amount of ash used is also very significant. Our processing plants are built in modules of 250,000 tonnes per year each.

Nu-Rock has had plants running for over 25 years in South Africa and Australia. Nu-Rock is currently engaged with a large utility in Southeast Asia that is building many ultrasupercritical plants. This site has the fourth plant currently under construction for $1.8 billion USD will produce 1,600 megawatts. Nu-Rock is building two, 2500,000 tonnes / year modules on this site. Many additional modules will be built on this 7,000 megawatt site serving about 6 million tonnes of ash per year.

In these cases, the coal comes in by ship and the product goes out on a ship at the same port. These ships can easily reach Europe and the United States with product. Purchase orders for the product are in hand.

We are working with 6 additional sites currently that do not envision any long-term ash storage on site.

Because the Nu-Rock process uses only 2% of the energy (PER) of an equivalent product, we generate a lot of carbon credits in locations that value them. We are currently undergoing testing with an Australian University to confirm and accredit the fact that every tonne of ash that Nu-Rock processes will create carbon credits. The data prove that
every 250,000 tonne module using Nu-Rock on the site of a power station will abate 125,000 tonnes of carbon emissions.

Our products are 100% sustainable and at the end of life they can be completely reused in the same process which is not the case for competing products.

To be clear, we use all ash coming from the power plant or landfill – fly ash, and bottom ash .... Obviously, we test the ash prior to building a plant. (More on this shortly).

We build our ash processing plant module on or very close to the power plant site so that road transportation of ash is minimized. The only thing shipped out of the ash plant is product. This is very positive from an environmental standpoint. Also, environmentally important is that the Nu-Rock process utilizes ash, waste water and access from the plant site. The electric load by the plant is very low and can be purchased from the grid. The Nu-Rock plant generates ZERO emissions to the air, ground and water – so in most jurisdictions, the only permits required are the normal building permits.

Nu-Rock has partnered with the premier block plant OEM in the world (MASA), this company has produced block plants for over 100 years. We have standardized on this equipment in our plants built to date and in our pilot plant in Denver, NC. This equipment was designed to make sure that products made in our pilot plant are the products that will be produced in a full size plant. We have also confirmed this in our plants running in Australia and South Africa. It also important to note that no major changes are made to the standard block plant except for changes necessitated by the Nu-Rock process.

Back to testing. Testing is done for a number of reasons:

**Prove the characteristics of the ash in the process:**

Certainly, the most important reason for the testing is to prove the process will perform well and to look at the characteristics of the various types of ash from a plant. The plant coal may have changed over the years and the ash in the landfill is not the same as that which is being produced in the plant today. This testing provides assurance to Nu-Rock and the plant owner that a viable product can be made from the ash and that the ash reduction envisioned will really happen.

**Determine products that can be made:**

As you all know, all ash is not made the same and with our process the strength, weight, water absorption and other characteristics vary depending on the ash. We have seen very good results from all types of ash and mixtures of ash, in the hundreds of tests we have performed. We test the ash and mixtures of ash from the power plant in various recipes to determine how they react in our process. We make coupons to determine the speed of the process and potential characteristics. Once a recipe or recipes are selected, we make actual brick from the ash. In most cases, we test the products to ASTM C90 standards. This is the standard for load bearing brick and block. The requirements are
that the average compressive strength of three tests must be 2,000 psi or more, with no test below 1,800 psi and that water absorption is less than 18%. While we can do this testing in house, it is very important that third party testing is utilized.

**Determine the potential market:**

Nu-Rock has had a third party study done of the brick and block market to determine, among other things, the US market for these products by state. From this information coupled with the information of what products we can make from this ash, we can determine what products would be of interest to various markets. From a plant owner standpoint, this is extremely important because while the shipping distance for ash by truck or rail may be a few hundred miles, the shipping distance for product is much larger and can even be worldwide as we have seen in many instances.

The results of this testing provides a report that will verify all of the above along with a financial model to determine the options for various stakeholders.

Below is a chart showing third party testing results from three different ashes utilizing various recopies with our process. You will note that the strength in almost all cases exceeds the 2,000 psi strength standard by 2 to 3 times, and that the water absorption is less than the 18% maximum by about the same margin. (Table A)

Table A, ASTM C90 Testing of Nu-Rock Products

Nu-Rock has done extensive testing with both US and Australian authorities. These tests include leachate (TCLP), radiation, insulation, fire proof .... A summery of some of the testing is below. (Table B)
Although we can customize a module larger or smaller, our standard module is 250,000 tonnes per year. That is taking 250,000 tonnes of your ash per year so the output of the plant is slightly more. This plant will make approximately 30,000,000 standard cinder block (if that is all that was made in a year). Use for these blocks are in standard building, although we can also make pavers, bricks, landscape block, jersey barriers and any other form currently being made by other means. These products are stronger as shown above and outperform standard products in virtually every respect. The products are about 50% of the weight, are 3 to 5 times the thermal insulation value, fire rated, and better acoustic value for the sound rating of the building.

It is very interesting to note that coal mines have also expressed a keen interest in these products. Coal mines use significant amounts of block every year in the mines. Given that these are less weight, stronger and less expensive they represent a very good “back haul” opportunity to the mines and railroad.

It is important that when situating the module(s) on the plant site that proper room and access be given for the number of trucks in and out of the facility and if available access to rail and water shipment. A single module will require 2 to 3 acres of space to handle the process building, minimal storage and shipping.

Nu-Rock and our subsidiaries take responsibility for construction, operation, maintenance of the facility. In addition, we handle the local, national and international sales, shipping, receiving and accounting.

The relationship between the Nu-Rock ash processing plant and the power plant / ash owner of the power plant site can vary from arm’s length to partnership. We are working with several companies that buy and own the plant after its been shut down. In doing this, we do not have the benefit of “fresh” ash from an operating plant but with the addition
of some additional equipment, the process works very well. This technology can also change the potential use of the land in the future. By eliminating the onsite ash, the site can be used for higher value usage. Some utilities are also investigating installing this technology so that the sale of the plant and liabilities can be accomplished for a higher price to the utility.

In addition to having thousands of structures made with Nu-Rock products, Nu-Rock has been endorsed by utilities, constructors and environmental organizations. We currently have purchase orders for a significant portion of a plant and commitments for additional product from various construction companies. This is driven by three benefits; the first is that it exceeds all specs needed for building; the second is that the products are significantly lighter, allowing the efficiency of building to increase dramatically; and third the cost of the block is 30% to almost 50% less. We have found that these benefits allow structures to be built with Nu-Rock for less money than wood.

Going forward, we will continue to work with the projects we currently have. I hope to be able to make some announcements in the near future. We are also exploring many other applications for this product in sewer pipe, salt water pipe, insulation for structural steel due to the very high attraction and bond to steel and has a high insulation value.

Thank you for your interest in the technology and Nu-Rock. We will be updating this group as we continue to make progress. We hope to mirror the activity we have seen in Asia here in the US.