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## **ORYKTA Mineral Goods –PMMR**

### The Utilization of ORYKTA Mineral Soil Amendment to Remediate Global Coal Fly-Ash Stockpiles.

Though we have well documented results on use of fly ash in agriculture, farmers practice of applying fly ash in the field is very negligible per cent. Because there is no lab to land program to popularize the use of fly ash in agriculture, the present technology demonstration showcase project on use of fly ash with ORYKTA in agriculture can solve the problem of unutilized fly ash stockpiled at power stations and also at the same time it will benefit the farmers economically by improving the yield of crops. It also improve the soil physical properties, soil fertility and reclaim the acidity and alkalinity of the soil to some extent due to pH nature of fly ash/ORYKTA blends obtained from different power stations. With this background, PMMR has formulated Terms of Reference (TOR) and Scope of the project. As per the TOR and Scope of the project consultation with Indian power generators. Trials in the farmers' fields near by Power Station areas have created awareness and confidence among the farmers on utilization of fly ash with ORYKTA in Agriculture. Fly-ash/ORYKTA blends boost the yields of variety of crops such as cereals, pulses, oil seeds, tuber crops, vegetables and sugarcane. By conducting technology demonstration trial in the farmers' holding, they have been convinced to follow this technology in large scale in their farms. By adopting this technology both the farmers and the power station will be mutually benefited. The first phase of this project has been completed four power generating units units in Simhadri (A.P), Dadri (U.P), Talcher Thermal (Orissa) and Vindhyachal (M.P)

Fly-ash has great potentiality in agriculture due to its efficacy in modification of soil health and crop performance. When combined with ORYKTA, the high concentration of elements (K, Na, Zn, Ca, Mg and Fe) found in fly-ash increases the yield of many agricultural crops. But the use of fly-ash in agriculture is generally limited to utilization with soil amendments such as ORYKTA. A blend of 20% w/w Fly-Ash with 80% w/w ORYKTA is most often recommended. It is known that crops across the world are grown in soil amended with coal fly ash.

Tons of fly ash are routinely added to soil to nourish vegetables, peanuts and other crops, primarily in the Midwest and Southeast sections of the USA. In China, India, and parts of Asia, blends of Fly Ash and ORYKTA have been successfully utilized to improve soil quality and crop yield.

Fly ash is a fine powder recovered from gases created by the burning of coal. It is the largest component of coal combustion waste, totaling around 70 million tons annually in the United States alone.

Adding moderate amounts increases crop yields and stabilizes soils while reducing the need to throw huge quantities in landfills or holding ponds, said Yuncong Li, University of Florida professor of soil and water sciences.



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However, fly ash may contain various amounts of contaminant metals. And studies have shown that food crops grown in large amounts of fly-ash may adsorb trace concentrations of contaminant. By blending with ORYKTA, this risk is mitigated.

Because it is not classified as hazardous waste under Environmental Protection Agency standards, there is no federal supervision of its use in agriculture. Some states regulate it but their guidelines vary and often require no monitoring of how it is used, said Jeffrey Stant, director of the Coal Combustion Waste Initiative for the Environmental Integrity Project. "For soil amendment, most cases are left to the industry itself to monitor where they put fly ash and how much they use of it," said Stant.

For more than a decade, companies have mixed fly ash with other waste to produce soil and compost. About 50,000 tons are used annually for agriculture nationwide.

One example is N-Viro, an international corporation that specializes in turning waste material into products. The company uses 250 tons of fly ash per day to mix with bio-solids, said Raymond Mayo, Florida N-Viro plant manager. The mixture is then heated to kill bacteria and monitored before it is distributed to farms, added Mayo. By utilizing ORYKTA with fly-ash, superior results can be realized; and, associated risks mitigated.

The volume of fly ash created by power plants is increasing, due to more coal burning coupled with more stringent air pollution rules. "Currently the U.S. produces 130 million tons of coal combustion waste every year. In another 10 years it will be 150 million," said Stant. As a result, researchers are studying whether even larger amounts can be blended with ORYKTA and used safely in agriculture.

*Fly-ash/ORYKTA mixtures provide phosphorus, calcium and other nutrients that crops need to grow while increasing soils' capacity to hold water, said Li. "The material is practically free and coal companies will pay people to dispose of it," he said.*

When the amount of fly ash in the soil amendment mixture is increased above 50%, crops tended to absorb higher concentrations of contaminants. Specifically, basil and zucchini contained potentially problematic amounts of trace contaminants exceeding 6 parts per million. It should be noted that concentrations of greater than 2 ppm had negative effects on vegetables, damaging the plants and decreasing production (2004 paper published in Environmental Geology). When blended 20/80% w/w with ORYKTA such issues were mitigated.

*Plants grown with smaller amounts of fly ash have fared much better. In a three-year study, University of Florida researchers successfully applied 22,000 pounds of fly ash per acre (1.1 percent of soil weight). Mixed with ORYKTA, the fly ash/ORYKTA blend could increase tomato yields by up to 70 percent. The study found no groundwater contamination or soil-fertility decline after three years, while the presence of trace metals remained below problematic levels.*



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A six-year study at the Indian Institute of Technology in Khargpur, India also indicated that a moderate amount of fly ash (9,200 pounds per acre), along with organic sources like ORYKTA farm manure would improve crop yields.

Blends of fly-ash with ORYKTA can increase rice and peanut yields by 31 and 24 percent respectively when compared to using chemical fertilizers alone. Accumulation of trace elements once again remained small.

Of the coal ash produced around the world, less than .02 percent is recycled for agriculture production, Li said, making it one of the least used byproducts of coal combustion. "As long as we work carefully with regulators we can apply larger amounts safely," said Li. "I think fly ash has a big potential to improve soil and increase plant growth." Potentially, a new international business model comprised of producing and marketing ORYKTA/Fly-ash blends could be realized. The mutual benefit to power companies and farmers would be unquestionable.

For nearly 50 years, coal combustion products have been used to fertilize peanuts. Air pollution control devices called scrubbers use a spray of slurry of ground limestone and water to remove sulfur dioxide from gases formed in coal combustion, said Tom Schmaltz, environmental director for Headwaters Resources, a world leader in coal combustion products. *Blended with ORYKTA, such a slurry could even further improve the chemical composition of the fly-ash.*

This practice leaves behind gypsum or "scrubber material," which can be processed and transformed into drywall or added to cement and soils. However, Bob Sutter, chief executive officer of the North Carolina Peanut Farmers Association, said the gypsum provides "much needed calcium and sulfur to the peanuts."

Contaminant metals are still found in the slurry, but in significantly lower concentrations than unprocessed fly ash, according to EPA studies. "Gypsum is well established," said Schmaltz. "We are also turning an underutilized resource into a valuable product that prevents (our) having to mine for minerals found in soil amendments. As coal waste grows, large reuse projects are taking place throughout the world.

The largest thermal power generating company in the India and has a coal based installed capacity of 25,375 MW with the production of 46 MT of ash . Fly ash accumulation and storage creates problem in the power producing units using coal as fuel. Use of coal fly ash in agriculture is one way of best disposal methodologies to utilize fly ash and at the same time it improves the yields of variety of agricultural crops and physico-chemical properties of soils. With this background and Annamalai University projects utilizing coal-ash in agriculture, we have created awareness among the farmers on utilization. More than 100 field trials have been successfully conducted. 50 MT of fly ash /ha applied in soil in the treated plot and maintained control plot (with out fly ash) separately side by side. Except fly ash application all other operations were common for treated and control plots. Results of the trials revealed that the application of fly-ash with ORYKTA could increase the yields of cereal crops to 15-20%; sugarcane to 20-30%; maize to 40%; red gram to 50%; potato to 25%; plantation crops to 30%; mustard



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to 30% and vegetables to 10%. Besides increasing the yields of crops it also improved nutrient uptake in crops and physical properties of soils especially water holding capacity and fertility status of soil. Farmers are convinced about the use fly ash in agriculture and interested to apply in more areas in the coming years.

We, at ORYKTA Mineral Goods (PMMR) look forward to working with you to optimize the use of fly-ash with our ORYKTA mineral soil amendment to remediate the stockpiles of fly-ash located around the world.