Minuta

Domos Geodésicos Geométrica, Encapsulamiento de materiales a granel.

Elaborado por: Priscilla Ulloa Menares y Felipe Robles Cartes.

Presentación por Juan Pablo Jijena
Viernes 6 de noviembre del 2015
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- El sistema estructural de Geométrica son las estructuras reticulares.
- A través de una retícula se puede descomponer una estructura en elementos simples que trabajan a tracción o compresión.
- La retícula es un sistema con el que se puede construir una estructura tomando como base 2 elementos: nodos y barras.

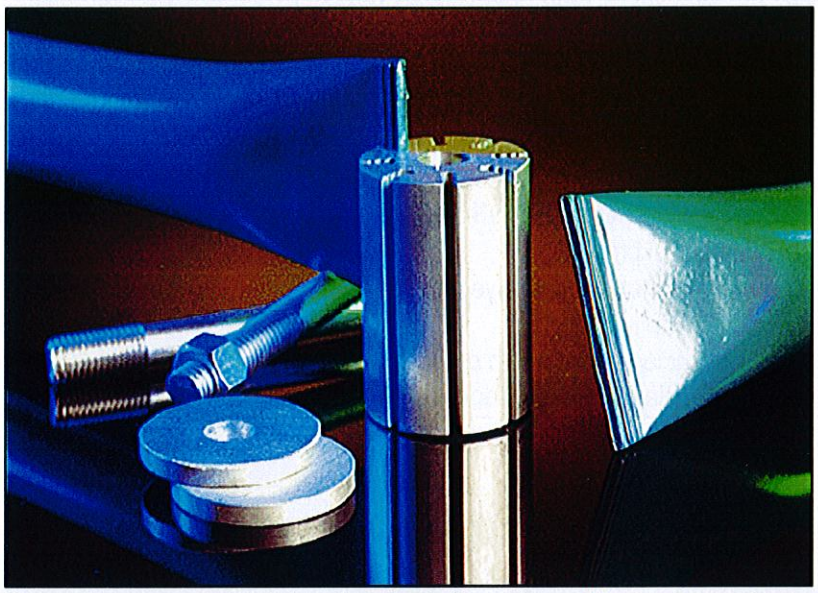

Figura 1: Barras de acero o aluminio estructural. Conectores de aluminio estructural de alta resistencia. Tornillería estructural.

- Los domos geodésicos pueden ser de una capa simple hasta 40 metros de diámetro o domos de capa doble de hasta 300 metros de diámetro.
- Otra solución de cubiertas son los 'arcos' que tienen curvatura sólo en una dirección (tipo un túnel), aplicado en la industria cementera y de plantas que poseen muchos equipos en su interior.
- La vida útil de un domo en condiciones extremas es como mínimo 30 años, en condiciones normales 60 a 70 años.
- Existen diferentes tipos de cubiertas para los domos, entre estas son: lona, acero, aluminio, plástico. La más usada es acero galvanizado.
- Se puede construir un domo sobre muros de concreto, como una combinación de silo y domo.

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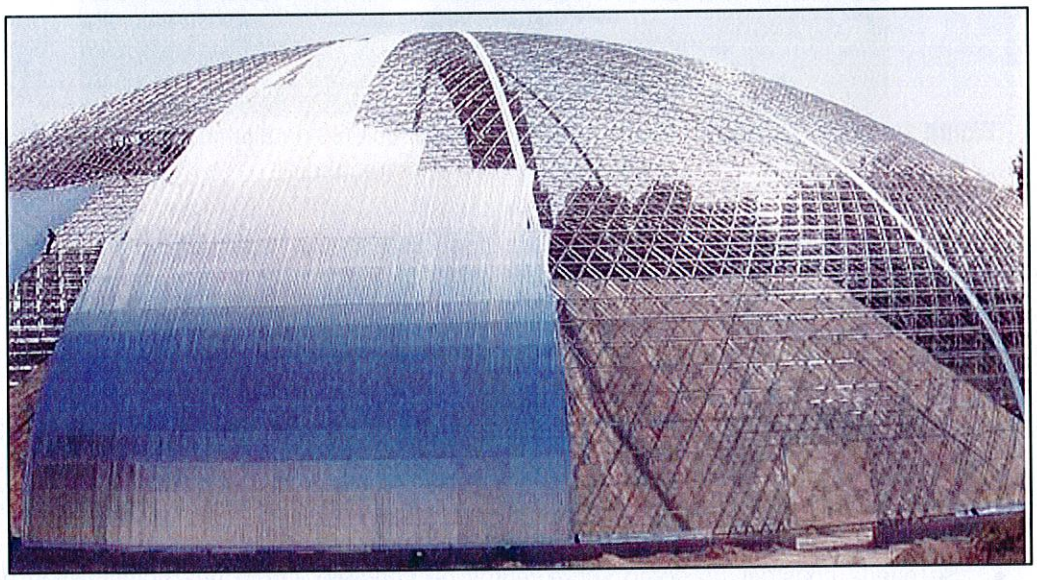
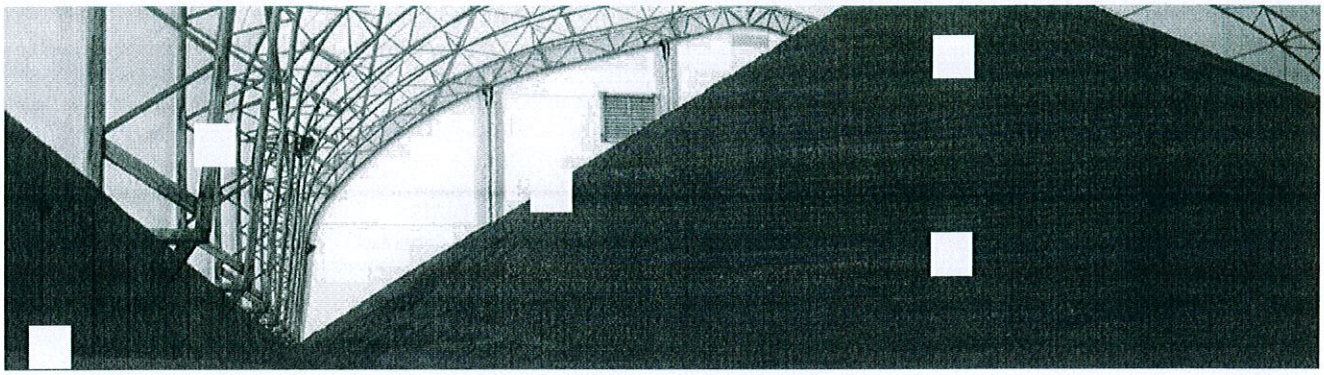
- Un freedome es un domo que se adapta a cualquier planimetría, se adaptan a la topografía del terreno, poseen una apariencia estética única.
- Proyectos importantes realizados en Chile: Caserones de 146 metros de diámetro (2013 a más de 4.000 msnm), 2 domos tipo Freedome (domo no tipo esfera, sino adaptable a configuración existente de la cancha) en construcción en central Bocamina de 150 metros.
- El proyecto Bocamina está en la etapa de obras civiles , el montaje del primer domo comienza en enero 2016 y terminará en julio el 1er domo y el 2do domo termina en diciembre 2016. Será el domo tipo Freedome más grande del mundo.
- Geométrica no construye, sino que otras empresas constructoras realizan ese trabajo, entre ellas están: Salfa, Besalco, Echeverría Izquierdo, etc.
- Un domo de diámetro bajo los 40 metros no es rentable económicamente, mejor opción un galpón convencional.
- El costo proyectado de diseño y suministro de materiales para el domo es aproximadamente de 200 USD/m2, más las obras civiles y el montaje de aproximadamente 250 - 300 USD/m2, dando un total de 450 a 500 USD/m2 en valores promedio.
- El diseño, construcción y montaje de un domo geodésico de 80 metros de diámetro toma en promedio aproximadamente 9 meses.
- Estos domos no necesitan energía de soplado, son estructuras de acero sobre una estructura de hormigón.
- Los domos no necesitan pilares en su interior es por eso que permiten utilizar todo el espacio disponible para apilar y se pueden construir mientras se sigue descargando en la pila, sin detener el proceso.
- Los tiempos asociados a un proyectos son:
    - Diseño de ingeniería — 8 semanas
    - Fabricación y suministro en obra y/o puerto — 14 semanas
    - Asistencia de montaje (domo 80 metros diámetro) — 14 semanas
    - Total aproximado — 9 meses





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Clear span space for bulk storage

The tension fabric structure benefits from no central support, making it possible for trucks, conveyors belts and stackers to easily operate within its walls. Our XP and XXP profiles provide the desired high side wall clearance needed for efficient bulk storage applications and maximum storage capacity.

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Our buildings are covered with a waterproof membrane which is designed to protect your bulk materials from the elements. In addition, our waterproof buildings help organizations comply with environmental regulations by assisting in the prevention of the leaching of soluble chemicals into the ground. As well, the ability to load and unload within the building also reduces waste.

MegaDome structures are bright and durable

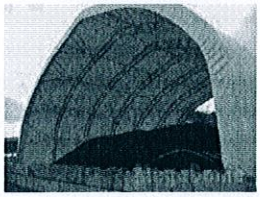
MegaDome buildings provide a bright, safe, and spacious work environment. Our PowerShield fabric cover allows natural light to penetrate, thus reducing the need for artificial lighting. MegaDome bulk storage solutions are designed, and manufactured, to resist corrosive elements, with options such as exhaust vents for truck fumes, and hot dipped galvanization for maximum corrosion protection.

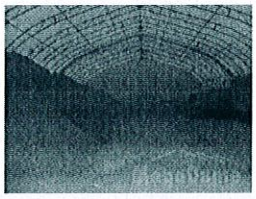
Flexibility

MegaDome storage building solutions offer flexibility, convenience, and great value for port authorities and other organizations involved in the transportation of dry materials. In addition, our modular buildings can easily be dismantled and moved to a new location, should the need arise.

Designed for safety

All MegaDome structures are designed to meet the building code requirements for the area where they will be built. Our bulk storage structures are certified under ISO 9001 and CSA A660-10 standards, meet Section 1 and 3 of the Eurocode, and offer worry free protection with one of the best available warranties on the market.





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Personal Storage, Allen Paul
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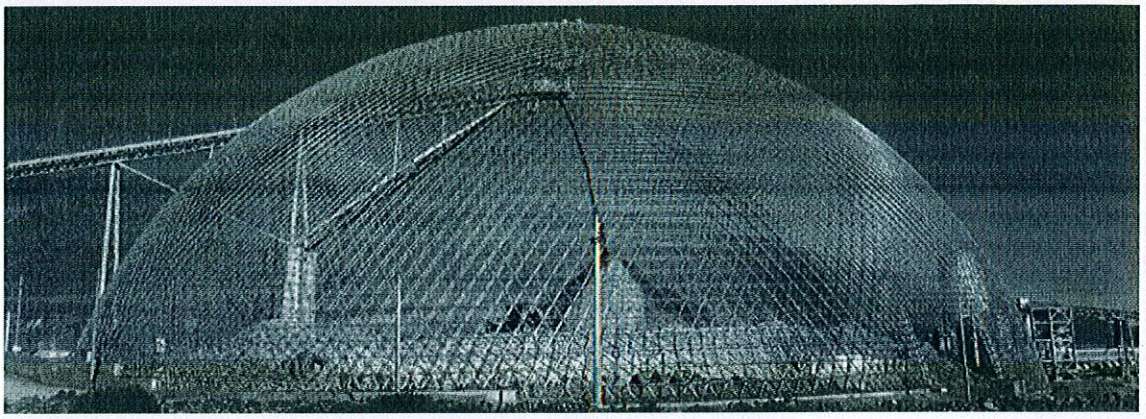


Geometrica designs and builds domes and space frames for Architectural, Industrial and Bulk Storage applications. 2 of 3

Bulk Storage

Geometrica builds bulk storage solutions for ring stockpiles, conical piles, longitudinal piles, and hazardous bulk materials. Column-free environments permit maximum use of space without the traditional restrictions of post and beam systems. Now mines, plants and factories can opt for a new vanguard in long span design in any terrain or climate.

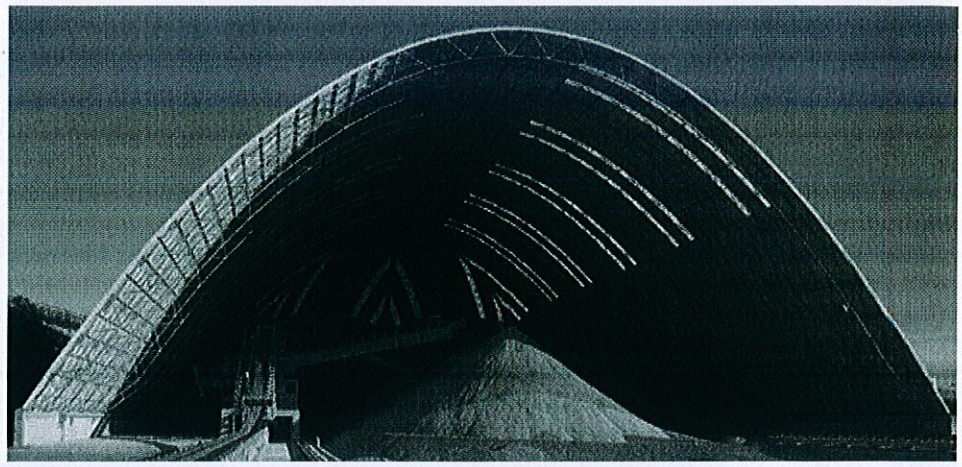
JEA Northside 400' coke storage dome with internal cladding

Covering Bulk Stockpiles

Power plants, mines, cement plants, ports and many other industries need to stock large quantities of dry bulk materials. These were traditionally left uncovered, or stored in vertical silos. But open stockpiles produce dust and contaminated runoff, and silos are small and expensive. Due to increasing environmental concerns, many organizations desiring covered storage have looked for and found a cost effective way to solve their problem: Geometrica's geodesic domes.

Material stockpiles may be classified in four general categories by their shape: ring, conical, longitudinal and free form.

Ring piles are formed by automated circular stacking/reclaiming (S/R) equipment having a slewing stacker at the center and a bridge reclaimer spanning the radius of the pile. A fixed drop from above forms conical piles. Linear S/Rs or trippers form longitudinal piles. And dumping material from trucks or stacking with moveable conveyors and spreading with front-end loaders forms irregular piles. Any of these types of piles may rest directly on the ground, or may be constrained at its perimeter by a wall. Geometrica's geodesic domes easily adapt to each of these types of piles and cover even the largest ones.



An example of a barrel vault covering raw material and machinery

A Proven System

Geometrica's geodesic domes are made with an efficient structural system of strong and corrosion resistant galvanized steel or aluminium. The light, prefabricated domes are containerized and shipped from our plant to anywhere in the world. Construction may proceed before, during or after material handling equipment is installed, and often the domes are built over existing live material stockpiles with minimal or no downtime.

The following articles feature domes and barrel vaults around the world, covering spans of all distances in the most challenging environments:

Domes for Sustainable Mining
Domes of over 100m
Quayside Storage Domes
The free-style dome at Planta Cerrillos
Green Cement at the Foot of the Mountain
El Brocal: Strength and beauty high in the Andes
The Velardeña Dome... in Video!
Official Opening of Caserones Copper Mine in Chile
Keeping Coal Clean

113m Limestone Domes, Lafarge, South Africa

The question is, "What can Geometrica do for you?" Please contact us via the Inquiry link below. A representative will respond with solutions to your bulk storage needs.

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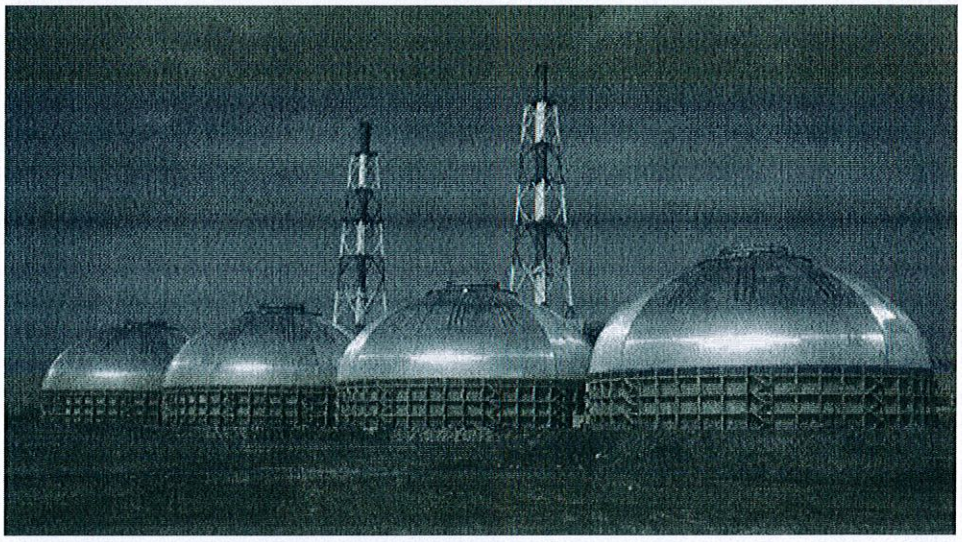
Coal Storage Domes

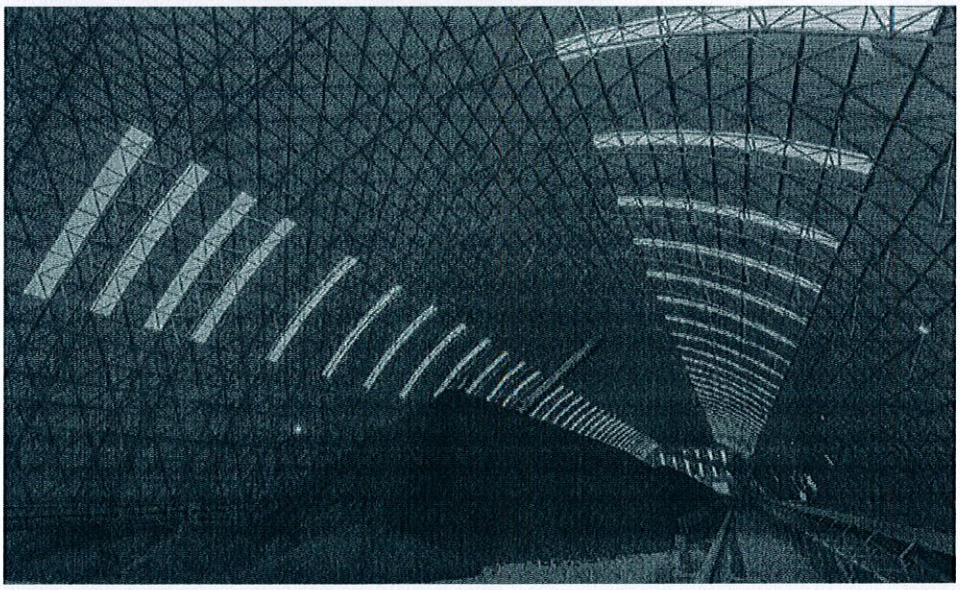
Geometrica designs and builds geodesic domes for storing coal, petcoke and other combustible bulk materials. Coal is often transported long distances and stocked at various points between the mine and the user. Thus, coal piles come in many shapes, from the huge multiline longitudinal piles frequently found at ports, to ring blending beds at large powerplants, to simple conical or irregular piles common at industrial plants.



Coal Storage Domes, 125m diameter, 180,000t each, Taiwan

Combustibility

Although many of the same issues that apply to most other bulk materials are encountered when storing coal, combustibility makes it a special case and deserves careful treatment. The following comments apply also to other combustible materials such as woodchips, grains and sulfur.



Longitudinal coal storage dome, 60m x 200m, Tunisia

The National Fire Protection Association, in its publications NFPA 850 and 120, identifies the hazards associated with storage and handling of coal, and gives recommendations for protection against these hazards. NFPA recommends that storage structures be made of non-combustible materials, and that they are designed to minimize the surface area on which dust can settle, including the desirable installation of the cladding underneath a building's structural elements.

Hazard Specific to Coal Storage: Explosion

Occurs with Concurrence of

• Explosive Dust Cloud	• Ignition
– Impact	– Spontaneous Combustion
– Earthquake	– Reclaimed hot spot
– Lightning, thunder, wind	– Conveyed hot material
– Machinery vibration	– Smoking, welding
– Fire fighting	– Static or equipment spark
– Sonic Boom	– Lightning
– Localized flare-out	– Methane flame

The recommendation requires an explanation. First, coal is susceptible to spontaneous combustion due to heating during natural oxidation of new coal surfaces. Second, coal dust is highly combustible and an explosion hazard. If a coal dust cloud is generated inside an enclosed space, and an ignition source is present, an explosion can ensue. Dust clouds may generate wherever loose coal dust accumulates, such as on structural ledges, if there is a nearby impact or vibration due to wind, earthquake, or even maintenance operations.

The table above indicates that explosions occur with concurrence of several factors. But because of coal's propensity to heat spontaneously, ignition sources are almost impossible to eliminate in coal storage and handling, and any enclosed area where loose dust accumulates is at great risk. Further, even a small conflagration can result in a catastrophic "secondary" explosion if the small event releases a much larger dust cloud.

Additional Safety Recommendations

The standards also recommend several other items, including:

Storage piles should be worked to prevent dead pockets of coal, a potential source of spontaneous heating. Storage of coal should be for as short a duration as possible. Coal piles should not be located above sources of heat such as, steam lines or manholes. Coal should be piled in layers and compacted to reduce air within the pile.

The coal should be kept as dry as possible (sprinklers are not recommended).

The piles should be constantly monitored for hot spots using temperature detection systems.

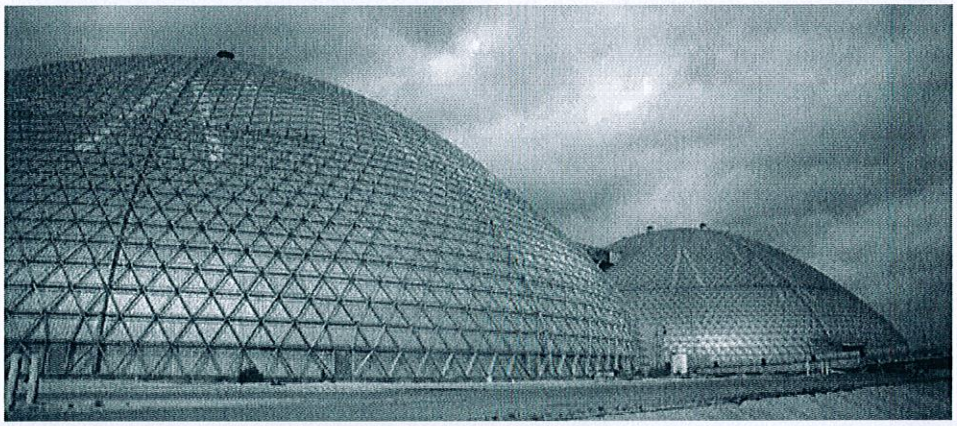
When a hot spot occurs a management strategy should be in place to remove the ignited coal. Access should be provided for firefigh' at sufficient intervals on the perimeter of an enclosure.

The structure should have minimal surfaces for dust to accumulate inside the dome. For all surfaces where dust may accumulate, adequate dust removal systems should be provided.

Ignition sources should be kept to an absolute minimum. Static electricity hazards should be minimized by the appropriate grounding of all equipment. All machinery and electrical equipment inside the dome should be approved for use in hazardous locations and provided with spark-proof motors.

Provisions should be made to turn off all electrical circuits without the need for personnel to enter dust-producing locations.

A sufficient ventilation system should be provided to reduce the chance of methane (and, in case of fire, smoke) build up and for explosion venting requirements. Ventilation should be provided at the apex to take advantage of the chimney effect. The structure should also be vented at the perimeter to reduce the damage to the structure due to blast overpressures.



122m petcoke storage domes with internal cladding, Florida, USA

Geometrica offers solutions to meet all the relevant recommendations. A dome protects the pile from rain and wind, which foster spontaneous combustion in open-air piles, and cause air and runoff pollution. Internal cladding prevents dust accumulation on the structure. A breakaway panel may provide for accidental overloading and ventilation at the base, and exhaust fans or ventilation openings insure against methane or smoke buildup.

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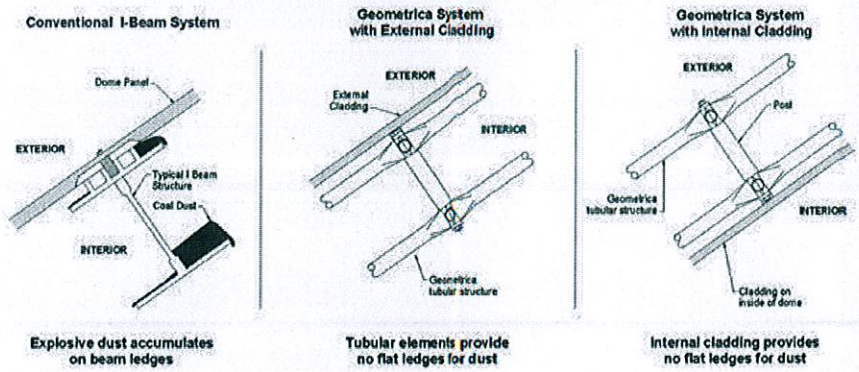
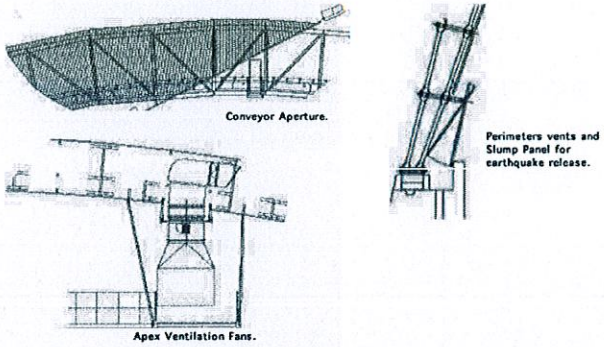
Comparison of Dome/Cladding Systems



Remarkable Long Span Applications

Geometrica has built the largest coal storage domes in the world, as well as domes for every coal pile shape (ring, conical, longitudinal and free-form). Typical coal dome sizes range from a 66m diameter dome over a 15m wall to store 35,000 t, to a 125m dome over an 18m wall for 180,000t. Capacity for domes on the ground varies with the shape of the pile. For instance, a 35,000t Freedome® required 3500 m2 of area, while 139,000t, 135m diameter piles have been covered with 144m diameter domes.

Dome features:



A case study on Geometrica coal storage domes is available as it appeared on September 2008 at the DCi Magazine (below).

Storing Coal For Tai Power.

The question is, "What can Geometrica design for you?" Please inquire to learn more.

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