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Standard Terminology for Coal Combustion Products[1]

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1. Scope

1.1 This standard defines terms used in the production, management and use of coal combustion products (CCPs). It is intended to promote understanding by providing precise technical definitions of terms used.

1.2 Terms used only within an individual coal combustion product (CCP) standard, and having a meaning unique to that standard, may be defined or explained in the terminology section of that individual standard.

2. Terminology

acid mine drainage (AMD), *n*—water exhibiting a pH of less than 6.0 and in which total acidity exceeds total alkalinity, discharged from an active, inactive or abandoned coal mine and reclamation operation or from an area affected by surface coal mining and reclamation operations.

acid mine water, *n*—see **AMD**.

admixture, *n*—a material other than water, aggregates, hydraulic cement, and fiber reinforcement, used as an ingredient of concrete or mortar, and added to the concrete batch immediately before or during its mixing.

advanced sulfur control products (ASC), *n*—products generated from advanced coal conversion technologies including FBC (fluidized-bed combustion) and gasification and products from advanced environmental emission cleanup technologies such as duct injection and lime injection multiphase burners (LIMB). The type of by-product is technology-dependent and could be a bed ash and high-lime fly ash for an FBC technology, etc.

aeration, *n*—exposing a substance or area to air circulation; the process of mixing air with a pulverized fuel or a powdered material such as fly ash in a transport pipe or storage bin.

aggregate, *n*—granular material such as sand, gravel, crushed stone, crushed hydraulic-cement concrete, iron blast furnace slag, or coal bottom ash and boiler slag used as a component in concrete or mortar with a hydraulic cementing medium to produce either concrete or mortar.

aggregate, lightweight (LWA), *n*—aggregate of low density. Examples of LWA include coal bottom ash, pumice, scoria, volcanic cinders, tuff, and diatomite; expanded or sintered clay, shale, slate, diatomaceous shale, perlite, vermiculite, or slag; and bonded or sintered coal combustion products (CCPs) used to produce lightweight concrete or component products.

alkali, *n*—salts of alkali metals, principally sodium and potassium; a hydroxide or carbonate of an alkali metal.

alkali metal, *n*—a metal in Group 1A of the Periodic Table, that is, lithium, sodium, potassium, rubidium, cesium, and francium.

alkalinity, *n*—the capacity of water to neutralize acids, a property imparted by the water's content of carbonates, bicarbonates, and hydroxides and occasionally borates, silicates, and phosphates. It is often expressed in milligrams per liter of calcium carbonate (see **calcium carbonate equivalent**).

ammoniated ash, *n*—ash that contains ammonia and/or ammonium salts as a result of the addition of ammonia or ammonium salts to the flue gas at the power plant.

angle of repose, *n*—the maximum angle from horizontal at which a given material will rest on a particular stationary surface without sliding or rolling.

aquifer , *n*—a geologic formation, group of formations, or part of a formation that is saturated with water and capable of providing a significant quantity of water.

ash pond, *n*—an impoundment or surface impoundment used to store or dispose of ash primarily from the combustion of coal. See **surface impoundment**.

baghouse, *n*—a facility that removes fly ash from the flue gas by the use of fabric filter bags.

batch, *n*—quantity of concrete, mortar, ash grout, or flowable fill mixed at one time.

beneficial use of a CCP, *n*—the use of or substitution of the coal combustion product (CCP) for another product based on performance criteria. For purposes of this definition, beneficial use includes but is not restricted to raw feed for cement clinker, concrete, grout, flowable fill, controlled low strength material; structural fill; road base/sub-base; soil- modification; mineral filler; snow and ice traction control; blasting grit and abrasives; roofing granules; mining applications; wallboard; waste stabilization/solidification; soil amendment and agriculture.

[1] This terminology is under the jurisdiction of ASTM Committee E50 on Environmental Assessment and is the direct responsibility of Subcommittee E50.03 on Environmental Risk Management/Sustainable Development/Pollution Prevention.

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beneficiation, *n*—improvement of the chemical or physical properties of a raw material or intermediate product by the removal or modification of undesirable components or impurities.

boiler slag, *n*—a molten ash collected at the base of slag tap and cyclone boilers that is quenched with water and shatters into black, angular particles having a smooth, glassy appearance.

borrow, *n*—an area designated as a source for soil in construction or mine reclamation projects; a source or sources of material other than the required excavation.

bottom ash, *n*—agglomerated ash particles formed in pulverized coal boilers that are too large to be carried in the flue gases and impinge on the boiler walls or fall through open grates to an ash hopper at the bottom of the boiler. Bottom ash is typically grey to black in color, is quite angular, and has a porous surface structure.

bulk density, *n*—the mass of a material per unit volume including voids. Bulk density is usually reported on a dry basis.

calcium carbonate equivalent (CCE), *n*—the content of carbonate in a liming material or calcareous soil calculated as if all the carbonate is in the form of $CaCO_3$.

calcium sulfate dihydrate ($CaSO_4 \cdot 2H_2O$), *n*—gypsum; the primary product of a forced-oxidation wet flue gas desulfurization system in which additional air is introduced and lime or limestone is used as the reagent.

calcium sulfite ($CaSO_3$), *n*—the primary product of a wet flue gas desulfurization system where there is no forced oxidation and lime or limestone is used as the reagent.

cap, *n*—a layer of clay or other low permeability material installed over the top of a closed landfill to prevent entry of rainwater and minimize leachate.

carbon reduction process, *n*—a process to reduce the concentration of carbon in high-carbon fly ash.

cell, *n*—a portion of a landfill that is isolated, usually by means of soil or an impermeable barrier, from its surroundings.

cementitious ash, *n*—fly ash, which hardens irreversibly when mixed with water. Also referred to as self-cementing ash.

cementitious material (hydraulic), *n*—an inorganic material or a mixture of inorganic materials that sets and develops strength by chemical reaction with water by formation of hydrates and is capable of doing so under water.

cementitious mixture, *n*—a combination of more than any one of the following materials to make a cement paste: hydraulic cement; Portland cement; coal fly ash; FBC ash; lime; ground granulated blast furnace slag; lime kiln dust; cement kiln dust. It may be used by itself for grout, or used to bind aggregates or fine materials to make concrete or controlled low strength materials (CLSM), or used for soil stabilization and solidification.

class C fly ash, *n*—fly ash, which meets criteria defined in ASTM C 618 for use in concrete.

class F fly ash, *n*—fly ash, which meets criteria defined in ASTM C 618 for use in concrete.

clean coal technology combustion products, *n*—products generated from any technology, including technologies applied at the pre-combustion, combustion, or post combustion stage, at a new or existing facility which will achieve significant reductions in air emissions of sulfur dioxide or oxides of nitrogen associated with the utilization of coal in the generation of electricity, or process steam which was not in widespread use as of November 15, 1990.

closure, *n*—the decommissioning of a disposal facility.

closure plan, *n*—a written plan that describes the steps the owner or operator of the disposal facility will take to close the facility in accordance with regulatory or other requirements.

coal ash, *n*—a collective term referring to any solid materials or residues (such as fly ash, bottom ash or boiler slag) produced primarily from the combustion of coal.

coal combustion products (CCPs), *n*—fly ash, bottom ash, boiler slag, fluidized-bed combustion (FBC) ash, or flue gas desulfurization (FGD) material produced primarily from the combustion of coal or the cleaning of the stack gases.

coal mine waste, *n*—the coal processing waste and underground development waste.

coal processing waste, *n*—the earth materials which are separated and wasted from the coal during cleaning, concentrating, or other processing or preparation of coal.

coal refuse, *n*—waste products of coal mining, cleaning, and coal preparation operation (for example, culm, gob, etc.) containing coal, matrix material, clay, and other organic and inorganic material. This does not include overburden from surface mines.

compaction, *n*—the densification of a soil or coal combustion product by means of mechanical manipulation; reduction in bulk volume of solid waste by rolling and tamping.

conditioned ash, *n*—ash that has been moistened with water during the load out process at the temporary storage silo at the power plant to allow for its handling, transport, and placement without causing fugitive dusting.

consolidation, *n*—the reduction in volume of a fill caused by movement of water out of the fill mass. Consolidation generally occurs due to an increase in the vertical stress on a fill. It is the movement of water rather than the compression of air-filled voids that distinguishes consolidation from compaction.

controlled low-strength material (CLSM), *n*—a flowable fill conforming to ACI 229 R.

cyclone, *n*—a cone-shaped air-cleaning apparatus that operates by centrifugal separation and is used in particle collecting and fine grinding operations.

deep mine injection, *n*—placement of materials such as ash and flue gas cleaning material into underground depleted mine cavities through boreholes, either pneumatically or hydraulically.

density, *n*—the mass per unit volume; weight per unit volume, expressed as grams per cubic centimeter or pounds per cubic foot for solids and liquids and usually as grams per liter for gases.

dewatering, *v*—a physical process which removes sufficient water from a sludge, FGD material, or ponded ash and FGD solids so that its physical form is changed from essentially that of a fluid to that of a damp solid.

dike, *n*—an embankment or ridge of either natural or synthetic

materials used to contain or hold a liquid, slurry, sludge, or other material in ponds.

discharge, *n*—the release of any solid, liquid or gas waste stream or any constituent thereof to the environment.

disposal facility, *n*—a facility or part of a facility at which waste is intentionally placed into or on any land or water, and at which waste will remain after closure.

double liners, *n*—a combination of two synthetic and/or natural buffers acting independently to separate waste from underlying soil and ground water.

drainage blanket, *n*—a uniform layer of permeable material such as sand, crushed stone, or bottom ash/boiler slag installed with properly designed filter media at the base of a structural fill to maintain the fill in a drained condition.

dry fly ash, *n*—fly ash that has been collected by particulate removal equipment such as electrostatic precipitators, Baghouses, mechanical collectors, or fabric filters.

electrostatic precipitator (ESP), *n*—a facility that removes fly ash from the flue gas by producing an electric charge on the fly ash and collecting it electrostatically.

encapsulation, *n*—the complete enclosure of a waste in another material in such a way as to isolate it from external effects.

ettringite, *n*—a high-calcium sulfoaluminate mineral ($Ca_6 \cdot Al_2(SO4)_3(OH)_{12} \cdot 26H_2O$).

filler, *n*—a substance added to a system or product to increase bulk, weight, viscosity, opacity, or strength.

final cover, *n*—cover material that is applied as part of closure of a landfill or surface impoundment.

fixated CCPs, *n*—CCPs that are blended with a cementitious binder to induce or enhance a pozzolanic reaction.

fixation, *n*—solidification or stabilization.

flowable fill, *n*—a material that flows like a liquid, is self-leveling, requires no compaction or vibration to achieve maximum density, hardens to a predetermined strength and is sometimes a controlled low strength material (CLSM).

flue gas conditioning, *n*—the process of adding chemicals such as sulfur trioxide or ammonia to the flue gas in order to improve the performance of the electrostatic precipitator (ESP) or reduce the opacity of emissions from the stack.

flue gas desulfurization (FGD), *n*—removal of gaseous sulfur dioxide from boiler exhaust gas. Primary types of FGD processes are wet scrubbers, dry scrubbers and sorbent injection. Sorbents include lime, limestone, sodium-based compounds and high-calcium coal fly ash.

dry FGD ash, n—see *dry FGD material*.

dry FGD material, n—the product that is produced from dry FGD systems and consists primarily of calcium sulfite, fly ash, portlandite ($Ca(OH)_2$), and/or calcite.

fixated FGD material, n—a designed mixture of dewatered FGD sludge that is primarily calcium sulfite with either a high-lime fly ash or a low lime fly ash combined with a cementitious material. FGD sludge is also known as scrubber sludge, scrubber material, FGD solids, filter cake or centrifuge cake.

lime spray drier ash, n—see *dry FGD material*.

stabilized FGD material, n—another name for *fixated FGD material*.

wet FGD products, n—the product of wet FGD processes or systems. It is composed primarily of water, calcium sulfite/sulfate solids, and small quantities of fly ash. Wet FGD products can be thixotropic.

FGD gypsum, n—gypsum formed from an oxidizing and calcium-based flue gas desulfurization process.

FGD material, n—a product of an FGD process typically using a high-calcium sorbent such as lime or limestone. Sodium-based sorbent and high-calcium coal fly ashes are also used in some systems. The physical nature of these materials varies from a wet thixotropic sludge to a dry powdered material depending on the process.

FGD material dry scrubbers, n—the dry powdered material from dry scrubbers that is collected in a baghouse along with fly ash and consists of a mixture of sulfites, sulfates, and fly ash.

fluidized-bed combustion (FBC) ash, *n*—the fly ash and bed ash produced by an FBC boiler.

fluidized-bed combustion (FBC) bed ash, *n*—the spent bed material that is produced by an FBC boiler. The bed ash is usually collected separately and can be considered as being equivalent to bottom ash in dry bottom or wet-bottom wall-fired furnace.

fluidized-bed combustion (FBC) products, *n*—the unburned coal, ash, spent bed material, and unreacted sorbent produced by an FBC boiler.

fly ash, *n*—coal ash that exits a combustion chamber in the flue gas and is captured by air pollution control equipment such as electrostatic precipitators, Baghouses, and wet scrubbers.

fly ash-lime content, *n*—the total calcium content of fly ash, including reactive and non-reactive calcium species expressed as calcium oxide (CaO).

forced oxidation, *n*—a process employed to supply additional air in wet FGD systems, resulting in the production of gypsum.

free lime, *n*—reactive lime and hydroxide species available to react with a pozzolan to form a cementitious product, usually expressed as a percentage by total weight of the product.

grout, *n*—a mixture of cementitious material and water with or without aggregate, sometimes incorporating CCPs, proportioned to produce a pourable consistency without segregation of the constituents. It is used for filling voids and spaces.

gypsum, *n*—name for calcium sulfate dihydrate ($CaSO_4 \cdot 2H_2O$).

landfill, *n*—a disposal facility where waste is placed in or on land.

leachate, *n*—the liquid including any suspended components in the liquid that has percolated through or drained from a pile or cell of solid materials.

leaching, *v*—the operation, natural or designed, of producing leachate.

lift, *n*—the depth of soil and other materials placed in an embankment or fill that can be compacted to the specified density with the available equipment.

lime, *n*—calcium oxide (CaO).

liner, *n*—a structure of natural and/or manufactured products that serves as a barrier to minimize leachate from reaching or mixing with the ground water.

loss on ignition (LOI), *n*—the weight change of a material when it is heated under prescribed conditions. The LOI level for coal combustion products is determined in accordance with ASTM Method D 3178 Instrumental Method.

mine subsidence, *n*—the downward displacement of the natural land surface in response to the removal of underlying supporting material by mining.

ponded ash, *n*—ash that is in an ash pond or that has been excavated from an ash pond.

pozzolan, *n*—siliceous or siliceous and aluminous materials that, in themselves, possess little or no cementitious value but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties.

pozzolanic activity, *n*—the phenomenon of strength development that occurs when lime and certain aluminosilicates react at ambient temperatures in the presence of water.

product, *n*—any object possessing intrinsic value, capable of delivery either as an assembled whole or as a component part or parts, and produced for introduction into trade or commerce.

reclamation, *n*—actions taken to restore mined land to a post mining land use approved by the regulatory authority.

run-off , *n*—water, which, having fallen on a surface, flows across the surface, picking up materials and will, if not collected, continue into a watercourse. Also any rainwater, leachate or other liquid that drains over land from any part of a facility.

scrubber, *n*—a pollution control device designed to remove gaseous elements from boiler exhaust gasses. See **flue gas desulfurization**.

scrubber material, *n*—see *FGD material*.

sedimentation, *n*—gravitational settling of solid particles in a liquid system.

self-cementing coal fly ash, *n*—see **cementitious ash**.

slurry, *n*—a mixture of water and any finely divided insoluble material in suspension.

soil modification, *n*—a change to the physical or chemical characteristics of soils.

soil stabilization, *n*—a soil modification that improves the physical characteristics of soils.

solidification, *n*—the conversion of liquids, slurries or sludges into a material that can be more easily handled or compacted for disposal or use; a process for converting a liquid to a solidified material; fly ash is often used as a reagent or sorbent in a solidification process.

sorbent , *n*—a chemical compound that is added to the gas side of the steam generator to reduce (sorb) emissions; a substance that decreases the concentration or availability of another substance by a sorption mechanism such as absorption and/or adsorption; a material that is used to soak up free liquids by either adsorption or absorption or both.

stabilization, *n*—a process for treating a waste to minimize an undesirable attribute of that waste; the treating of solids from wet scrubbing or other air pollution control processes; fly ash is often used as a reagent or filler.

stabilized CCPs, *n*—see **fixated CCPs**.

structural fill, *n*—an engineered fill, typically constructed in layers of uniform thickness and compacted to a desired unit weight in a manner to control compressibility, strength, and hydraulic conductivity.

surface impoundment, *n*—a facility or part of a facility which is a natural topographic depression, man-made excavation, or diked area formed primarily of earthen materials (although it may be lined with man-made materials) which is designed to hold an accumulation of liquid wastes or materials containing free liquids and which is not an injection well.

thixotropic, *n*—the property of a material that enables it to stiffen in a relatively short time on standing but, upon agitation or manipulation, to change to a very soft consistency or to a fluid of high viscosity, the process being completely reversible.

top ash, *n*—another name for fly ash. See **fly ash**.

treatment, *n*—any method, technique, or process designed to change the physical, chemical or biological character of a waste to neutralize the waste, render it less hazardous, make it safer to transport or manage, or reduce its volume.

unburned carbon (UBC) in ash, *n*—the unburned carbon in fly ash includes both carbon carried over as uncombusted “inertinite” and chars or cokes resulting from the incomplete combustion of thermoplastic, largely vitrinite-derived phases. The latter include “isotropic coke” and “anisotropic coke.”