MOSUL UNIVERSITY
PETROLEUM & MINING
ENGINEERING COLLEG

OIL WELL CEMENTING

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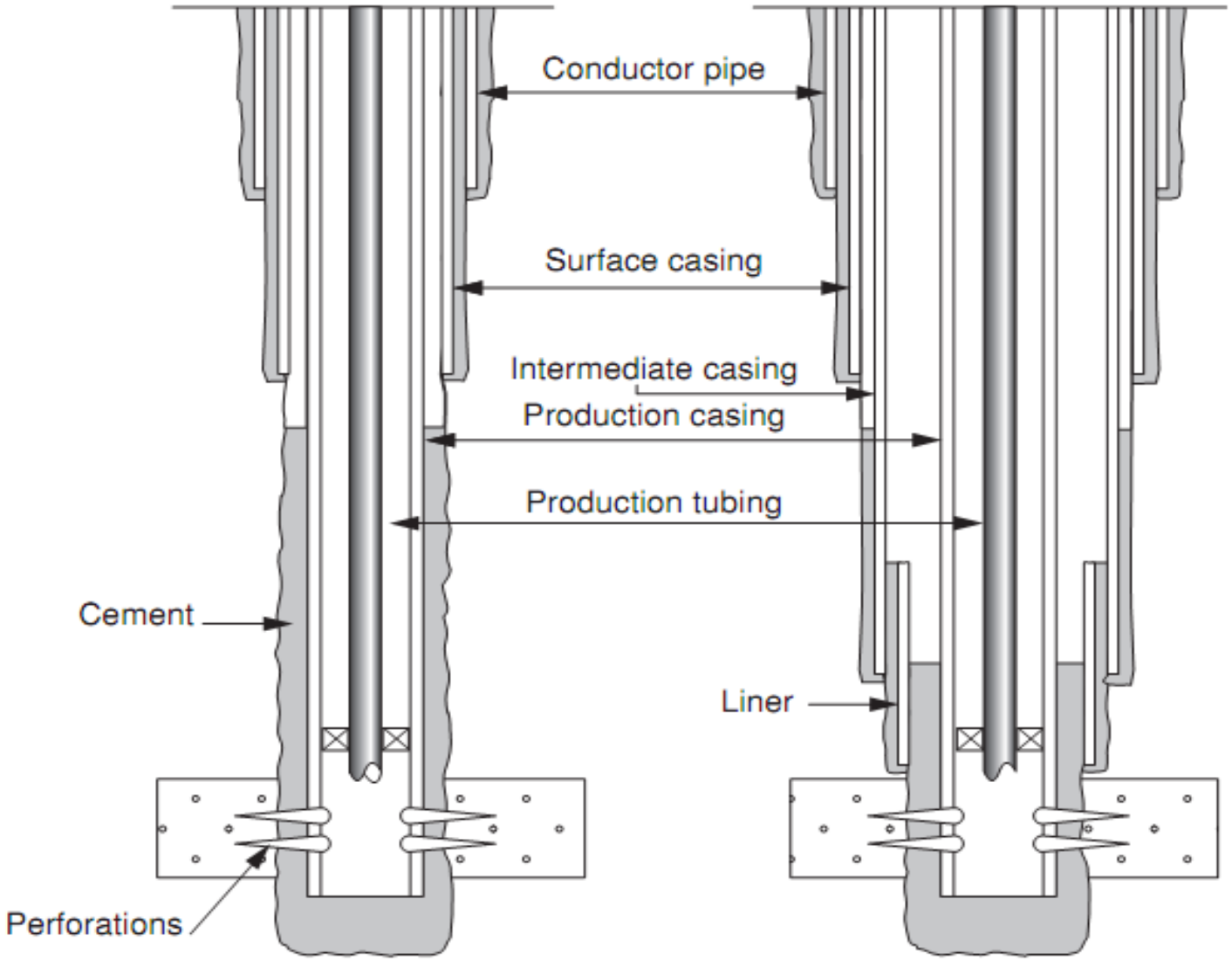
2024-2025

Cement:

Cement : **is used primarily as an impermeable seal material in oil and gas well drilling. It is most widely used as a seal between casing and the borehole, bonding the casing to the formation and providing a barrier to the flow of fluids from, or into, the formations behind the casing and from, and into, the subsequent hole section.**

Cement: **is also used for remedial or repair work on producing wells. It is used for instance to seal off perforated casing when a producing zone starts to produce large amounts of water and/or to repair casing leaks.**


Conductor pipe
Surface casing
Intermediate casing
Production casing
Production tubing
Cement
Liner
Perforations
Normally pressured
Abnormally pressured

CEMENTATION

Oil Well cementing is the process of mixing a slurry of cement and water and displacing it down the casing, tubing or drill pipe to a pre specified point in the well

Primary cementing → Casing Cementation

The cementing takes place soon after the lowering of casing is called primary cementation.

Secondary cementing

Any other operations where cement is pumped in a well either during drilling operation or in production phase.

Primary Cementation

Q/ Why we need to pump cement in a well?

- An oil/gas well is completed in stages.
- Each stage is secured /completed by lowering a suitable size steel pipe (casing).
- The casing pipes are held in its position by an adequate length of cement bond between pipe and annulus.
- Cement is mixed with water to form a cement slurry of desired density and pumped into the pipe and displaced in the annulus between casing and open hole.

Main Functions

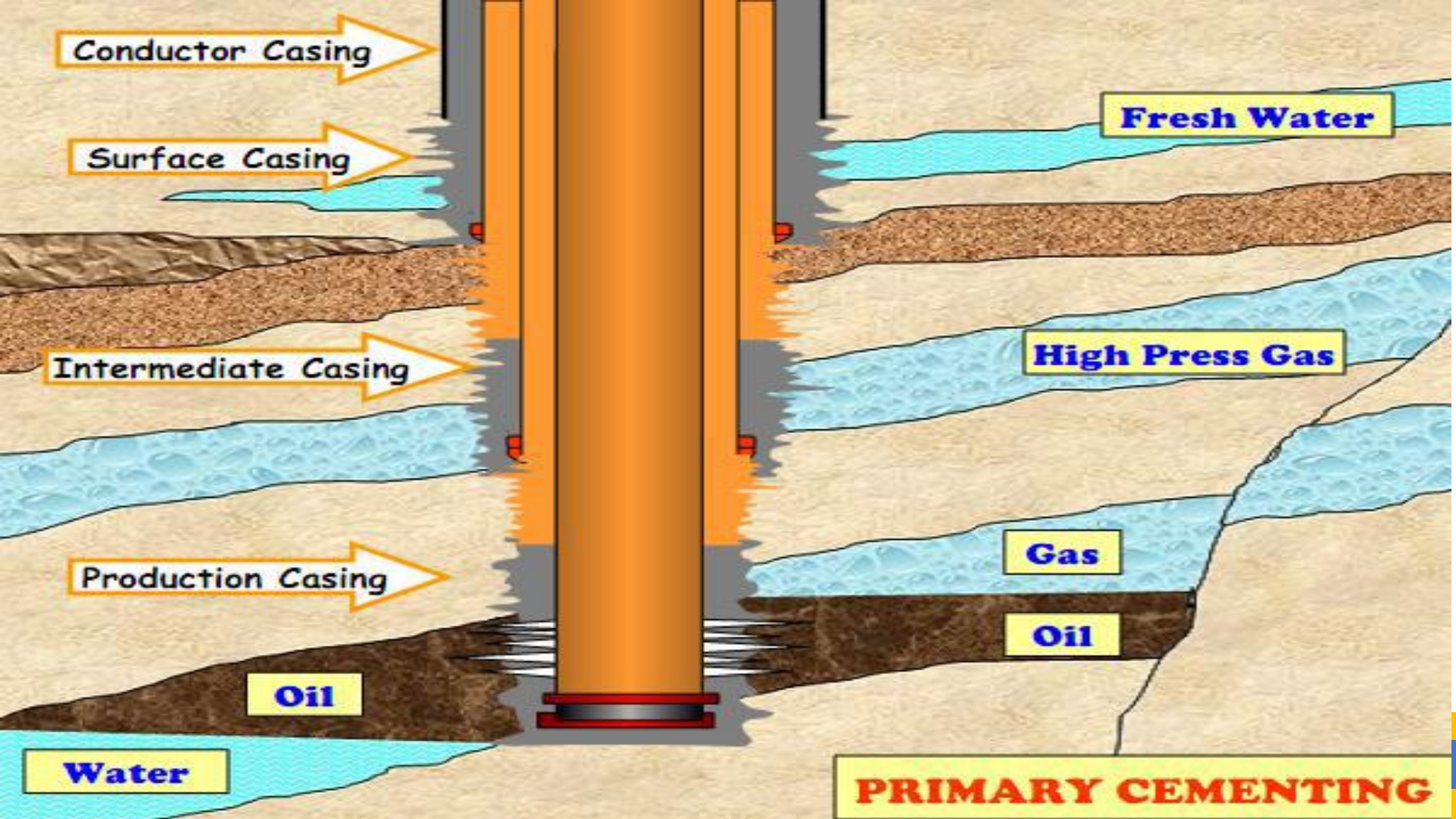
01 **Bond and support the casing**

02 **Protect the casing from corrosion.**

03 **Protect the casing from shock loads.**

04 **Sealing-off problematic zones.**

05 **Restrict fluid movement between formations**


Conductor Casing
Surface Casing
Intermediate Casing
Production Casing
Fresh Water
High Press Gas
Gas
Oil
Oil
Water
PRIMARY CEMENTING

CEMENT MANUFACTURE AND CHEMISTRY

- Cement is made from calcareous and argillaceous rocks such as limestone, clay and shale and any other material containing a high percentage of calcium carbonate. The dry material is finely ground and mixed thoroughly in the correct proportions. The chemical composition is determined and adjusted if necessary. This mix is called the kiln feed.
- The kiln feed is then heated to temperatures of around 2600-2800 F (1427-1538 C). The resulting material is called clinker. The clinker is then cooled, ground and mixed with a controlled amount of gypsum and other products to form a new product called Portland cement. Gypsum ($CaSO_4.2H_2O$) is added to control the setting and hardening properties of the cement slurry and to prevent the flash setting cement.

l cement manufacture flow diagram,

CALCAREOUS-2 parts
- Limestone ($CaCO_3$)
- Cement rocks
- Chalk
- Marl
- Marine shells and coral
- Alkali waste

ARGILLACEOUS- 1 part
- Clays
- Shales
- Slate and Mudstones
- Blast furnace slag
- Ashes (fly ash)
- Cement rock

Grind + Heat Treat in Kiln ↓ Temperature + 1500°C

CEMENT CLINKER
- C_3S : Tricalcium Silicate (Ca_3SiO_5):Major component
- C_2S : Dicalcium Silicate
- C_3A : Tricalcium Aluminate
- C_4AF : Tetracalcium Aluminoferrite
- Ca + Mg Oxides, $Ca(OH)_2$, $CaCO_3$, Na_2SO_4, etc

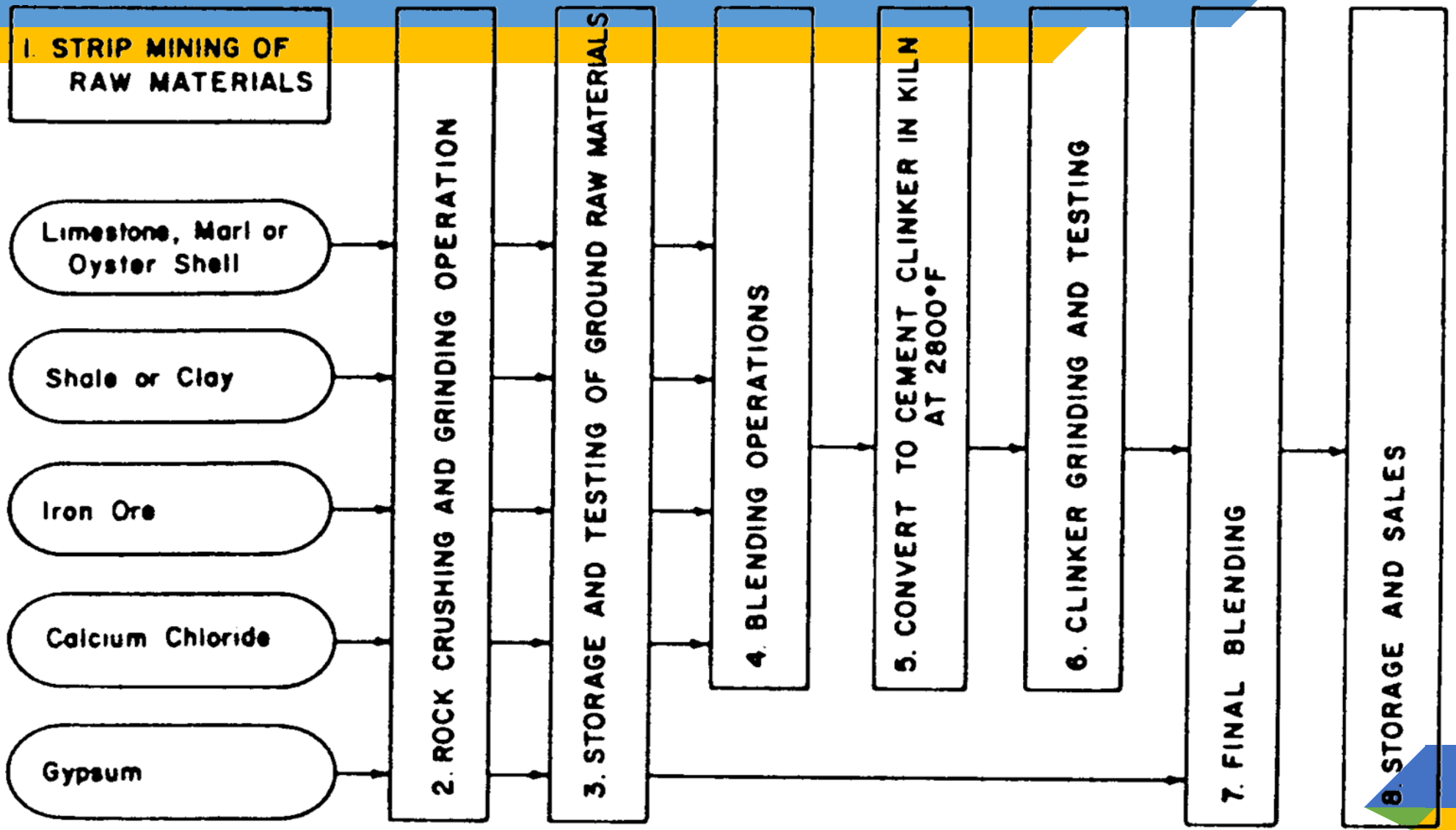
Controlled Cooling ↓ To second grinding mill

ADD 3 - 5% Gypsum ($Ca.SO_4.2H_2O$), or Blend of Gypsum + Plaster

Pulverise mixture ↓ And Blend

PORTLAND CEMENT

Manufacturing of Portland Cement



STANDARD CEMENT CLASSES DESIGNATED BY API'

Class A: **Intended for use from surface to 6,000-ft (1830-m) depth, when special properties are not required. Available only in ordinary type (similar to ASTM C 150 Type I).**

Class B: **Intended for use from surface to 6,000-ft (1830-m) depth, when conditions require moderate to high sulfate-resistance. (similar to ASTM C 150, Type II) and high sulfate- resistant types.**

Class C: **Intended for use from surface to 6,000-ft (1830-m) depth, when conditions require high early strength. Available in ordinary and moderate (similar to ASTM C 150, Type III) and high sulfate-resistant types.**

ASTM=American Society for Testing and Materials

Class D:

Intended for use from 6,000- to 10,000-ft depth (1830- to 3050-m) depth, under condition s of moderate and high temperatures and pressures.

Available in both moderate and high sulfate- resistant types.

Class E:

Intended for use from 10,000- to 14,000-ft (3050- to 4270-m) depth, under conditions of high temperatures and pressures. Available moderate and high sulfate-resistant types.

Class F:

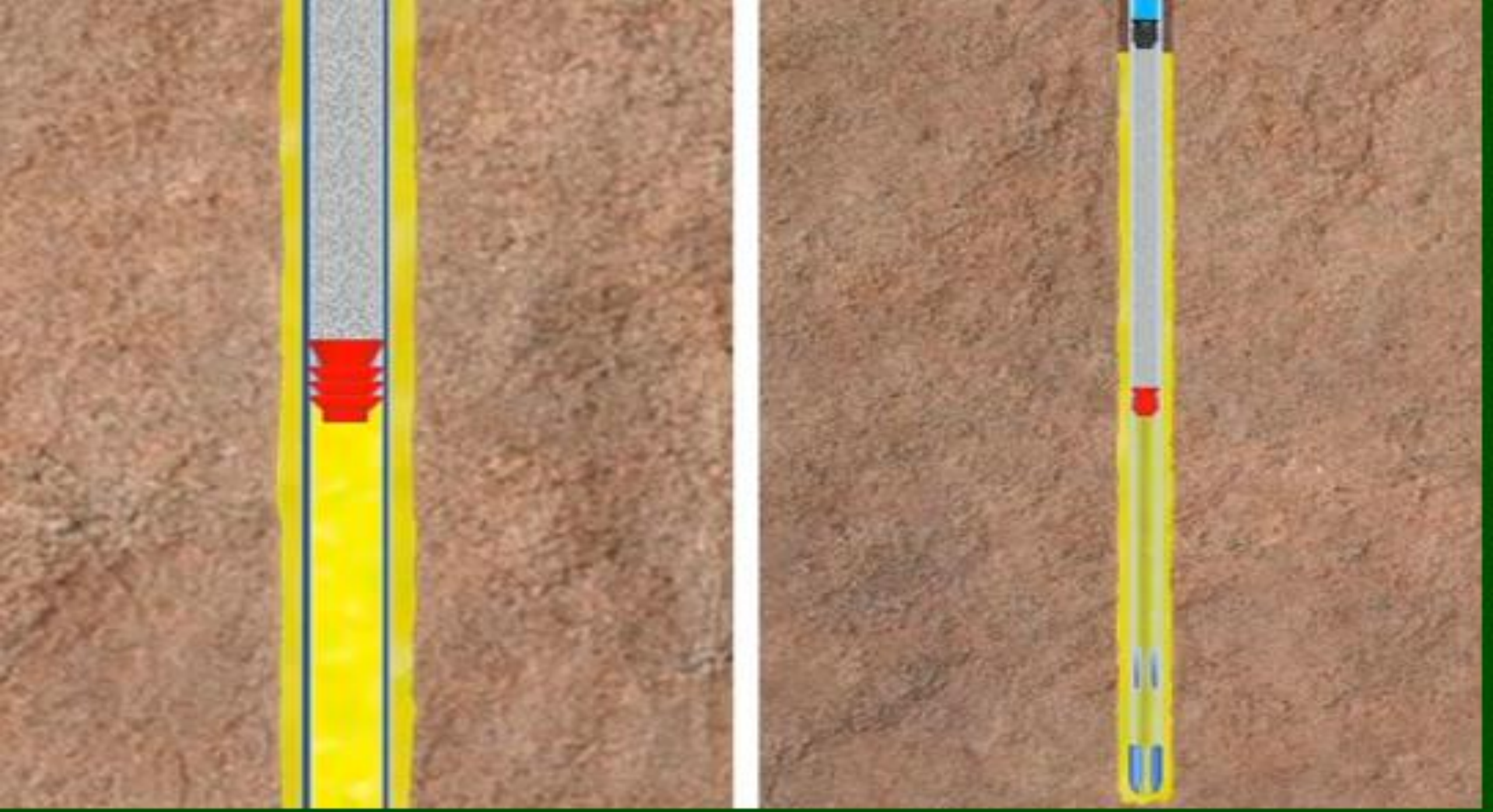
Intended for use from 10,000- to 16,000-ft (3050- to 4880-m) depth, under conditions of extremely high temperatures and moderate and high sulfate-resistant types.

Class G:

Intended for use as a basic cement from surface to 8,000-ft (2400-m) depth as manufactured, or can be used with accelerators and retarders to cover a wide range of well depths and temperatures. No additions other than calcium sulfate or water, or both, shall be interground or biended with the clinker during manufacture of Class G cement. Available in moderate and high sulfate-resistant types.

Class H:

Intended for use as a basic cement from surface to 8,000-ft (2440-m) depth as manufactured, and can be used with accelerators and retarders to cover a wide range of well depths and temperatures. No additions other than calcium sulfate or water, or both, shall be interground or blended with the clinker during manufacture of Class H cement. Available only in moderate sulfate-resistant type.



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