PETROCHEM

CEMENTING SURFACE PIPE

INTRODUCTION

The first string of any consequence that goes into a well is called "surface casing". It is set deep enough to protect the well from cave-in of loose formations that are often encountered near the surface, but its primary purpose is to protect fresh water zones form contamination. It is the starting point of the casing head and other fittings that will be left on the completed well. The setting depth of surface casing may be-only 200 feet or so, but sometimes it is as great as several thousand feet. Regulations for the protection of underground reservoirs of fresh water are usually quite specific about the amount of surface casing that must be run.

In addition to protecting fresh water zones, the surface string must be set deep enough to reach competent formation that will not break down under the weight of the drilling mud.

The casing selected must be strong enough to support a blowout preventer and to withstand gas or fluid pressures that might be encountered. Surface casing should have the strength to provide a solid anchor for the casing head when the well is put on production. Ordinarily, the burst strength should be equal to 1 psi per foot of depth to which it is set, i.e., if the string is set at 2,000 feet its burst strength should be at least 2,000 psi, which is about the maximum pressure that would be encountered at the depth.

Surface casing may be used to support part of the suspended weight of casing run into the well after the surface string is set. This is usually accomplished by cementing the surface casing from the shoe to the surface. The inner strings may be suspended by hanging their weight on the casing head.

RECOMMENDATION FOR PREVENTING SURFACE PIPE FAILURES

The recommendations discussed below are based on field practice and are suggested as methods to help prevent surface pipe failures:

1. Both top and bottom plugs should be run. For 13 3/8 or larger casing inner string cementing is done.

2. A minimum of 20 to 30 feet of cement should be left in the pipe with a positive means of stopping the plugs.
3. The top plug should be dropped on the fly before the slurry weight starts to drop off.

The cement - to pipe bond can be improved by using a chemical wash or spacer ahead of the cement. A volume of wash or spacer should be used that is equivalent to a 500-foot column in the annulus, with a minimum of 10 barrels.

The type of cement used is important. API Classes A, G and H are generally satisfactory, but Class C is often preferred because it develops high, early strength. The use of 2% calcium chloride or 5-10% sodium chloride as an accelerator is advantageous.

In some areas, drilling below the surface string can result in the lower joints being severely battered by a rotation drill string. In such areas it may be desirable to use a special "tail-in" slurry that will provide a hard higher strength cement. A reduced water slurry is often used to help solve this problem. Placing such a slurry over at least the lower 10% of the string will usually provide the protection needed.

Checking the mix water temperature is recommended to be sure the slurry will have a temperature of at least 60°F. If not, it is desirable to heat the mix to 60-80°F.

The cement should never be over-displace. It is better to under-displaced. Enough slurry should be run to circulate to the surface.

Waiting on cement time (WOC) must be kept to a maximum. Generally, 6 to 8 hours is allocated for WOC time during warm weather and as much as 1 to 24 hours may be required if the weather is cold. The required compressive strength may vary form 500 psi in some areas to as much as 1000 psi when drilling condition require it.

Typical data, showing the development of compressive strength for Class A cement, are shown in Table I. This data is intended to show the range of strength development that can be expected. Note the effect of increasing slurry density. Actual laboratory data using the actual brand and class of cement to be used in encouraged as the best basis for treatment design.

TABLE I

TYPICAL DATA FOR CLASS A CEMENT

	Slurry Weight lb/gal	60°F - Compressive Strength (psi) in 3 hrs	4 hrs	5 hrs	6 hrs	8 hrs	16 hrs	24 hrs
Neat Cement	15.6	-	-	-	-	-	183	422
Neat Cem. + 2% $CaC1_2$	15.6	-	36	80	118	319	714	1275
Neat Cem. + 3 % $CaC1_2$	15. 6	15	66	113	183	300	620	1173
Neat Cem. + 2% $CaC1_2$	16.5	33	81	200	346	600	1282	2368
Neat Cem. + 3 % $CaC1_2$	16.5	61	189	263	455	654	1402	2198
Neat Cem. + 2 % $CaC1_2$ + 1 % P-DIS	17.5	12	64	95	220	762	1987	4537

	Slurry Weight lb/gal	60°F- Compressive Strength (psi) in 3 hrs	4 hrs	5 hrs	6 hrs	8 hrs	16 hrs	24 hrs
Neat Cement	15.6	-	-	-	22	150	750	1642
Neat Cem. + 2% $CaC1_2$	15.6	125	201	350	543	863	1612	2681
Neat Cem. + 3 % $CaC1_2$	15.6	158	317	548	681	792	1581	2162
Neat Cem. + 2% $CaC1_2$	16.5	299	391	548	681	792	1581	2162
Neat Cem. + 3 % $CaC1_2$	16.5	359	687	1155	1385	1580	2530	3600
Neat Cem. + 2 % $CaC1_2$ + 1 % P-DIS	17.5	190	387	627	1680	2303	4177	7863