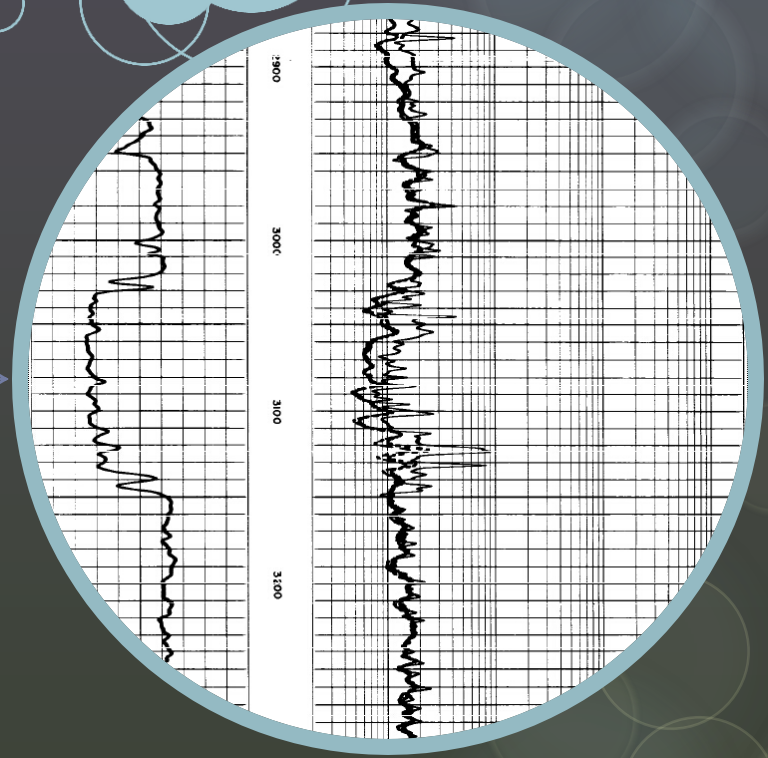


LOGGING REQUIREMENTS

Louisiana Department of Natural Resources
Office of Conservation
Injection and Mining Division

ELECTRIC LOG

What is it?

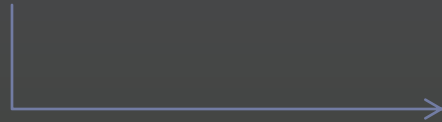


Electric logs – *or open-hole logs as they are also called* – are used to help identify the base of the Underground Source of Drinking Water (USDW), other formations of interest and also to locate sand and shale intervals in order to define an injection or disposal zone. Some examples are:

- Gamma Ray (GR)
- Spontaneous Potential (SP)
- Resistivity
- Density
- Neutron Porosity
- Caliper, etc.

ELECTRIC LOG

When is it required?

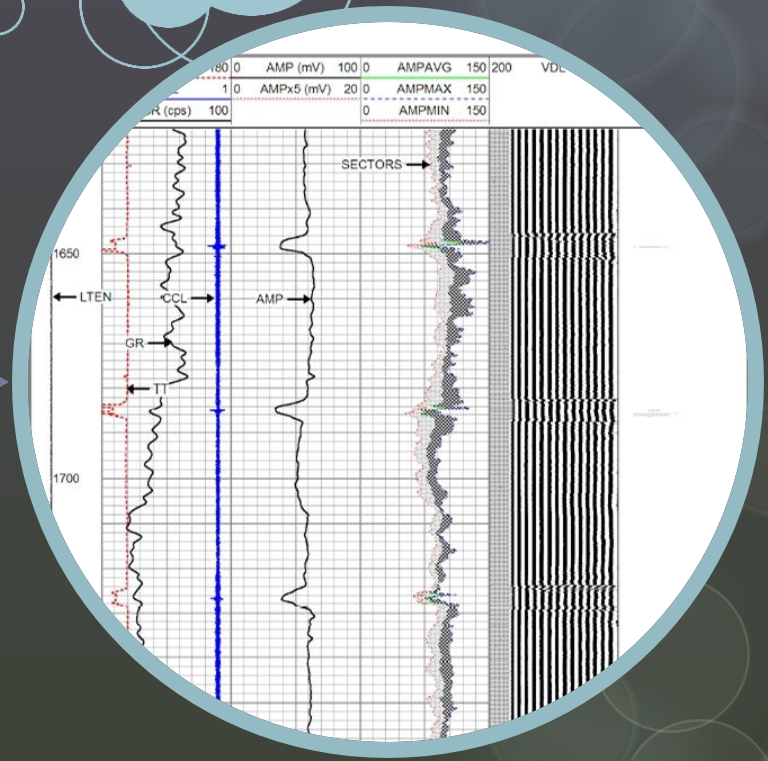


If electric logs of a nearby (*within 1/4-mile*) well were not run through the lowermost USDW, a new well must be logged from surface to total depth (TD) before setting casing.

If an electric log exists from a nearby well that shows the USDW, the new well only has to be logged electrically below the surface casing before the long string is set in order to assist in determining the injection or disposal zone.

CEMENT BOND LOG (CBL)

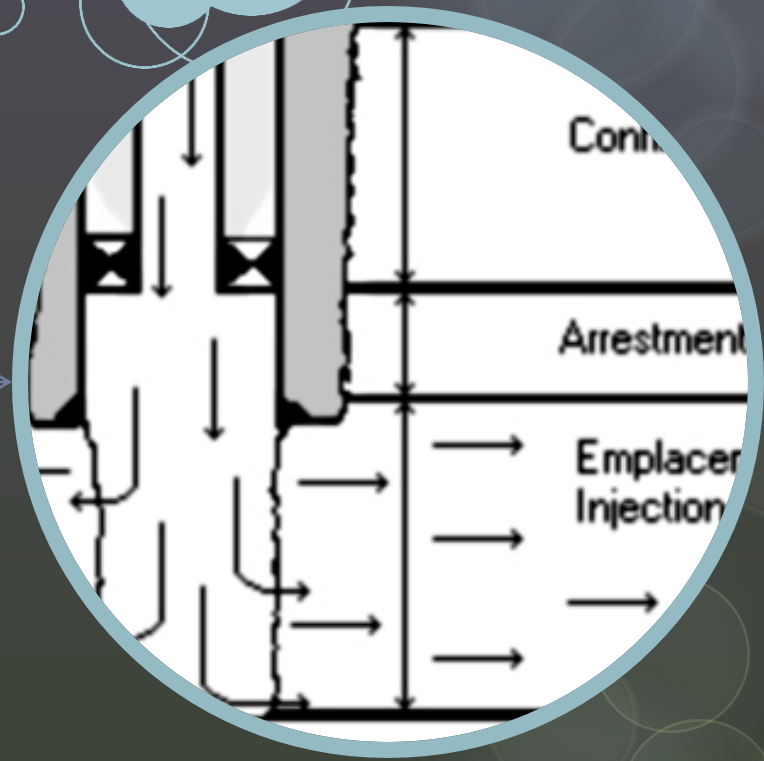
What is it?



A cement bond log (CBL) is a type of log that measures the loss of acoustic energy as it passes through casing.

CEMENT BOND LOG (CBL)

What is it used for?



Cement bond logs are used to detect the presence or absence of external cement behind casing.

CEMENT BOND LOG (CBL)

When is it required?

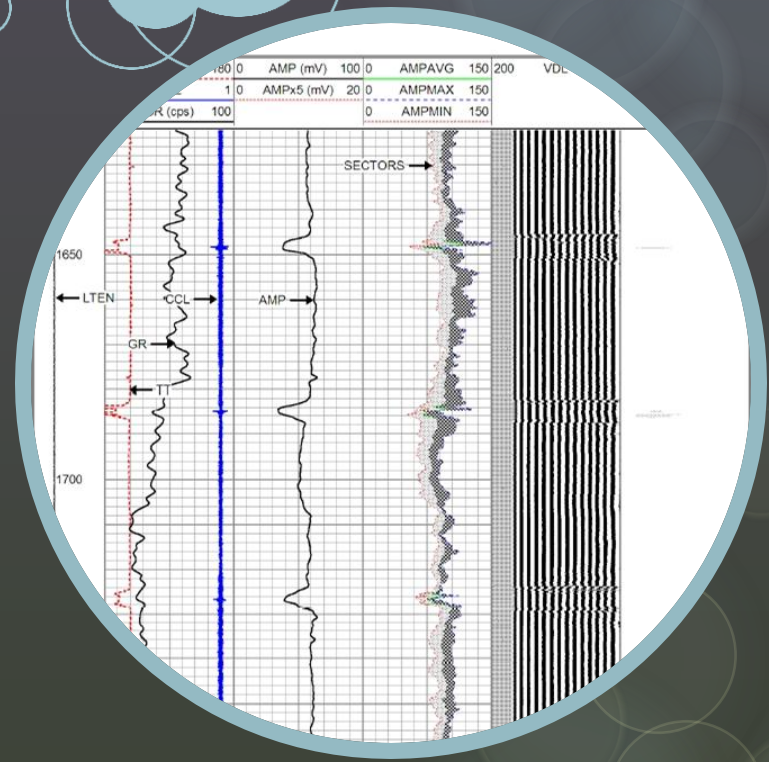


Cement bond logs are required to be run on all new-drills, conversions and zone changes.

Please note that Injection and Mining cannot accept the portion of a CBL which has been run "pipe-inside-pipe".

CEMENT BOND LOG (CBL)

What are we looking for?



Minimum interval of continuous 60% bonded cement in a continuous confining shale.

Rule-of-Thumb: $< 10\text{mV}$ on amplitude curve for x-amount of feet.

For heavier casings, can sometimes accept $< 12\text{mV}$ or $< 13\text{mV}$ but this is fairly RARE.

CBL Interpretation Guide:

Cement Bond Log Interpretation Guide						
Casing Size	Weight	Travel Time μ -sec	Free Pipe Signal	Class H Cement		Interval for Isolation
				3000 psi 100% emt	60% bond cut off	
4 1/2"	9.5	254	81 mv	0.2 mv	2.3 mv	5 feet
	11.6			0.6mv	4.6 mv	
	13.5			1.0 mv	7.0 mv	
5"	15.0	258	76 mv	0.9 mv	5.5 mv	5 feet
	18.0			2.2 mv	10.0 mv	
	21.0			3.6 mv	15.0 mv	
5 1/2"	15.5	269	72 mv	0.7 mv	4.8 mv	6 feet
	17.0			1.0 mv	5.0 mv	
	20.0			2.1 mv	9.0 mv	
	23.0			3.5 mv	13.0 mv	
7"	23.0	269	62 mv	1.0 mv	5.5 mv	11 feet
	26.0			1.7 mv	7.5 mv	
	29.0			2.4 mv	9.3 mv	
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	35.0			4.0 mv	14.0 mv	
	38.0			5.0 mv	15.0 mv	
40.0	6.0 mv	17.0 mv				
7 5/8"	26.4	302	59 mv	1.1 mv	5.5 mv	12 feet
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	39.0			3.5 mv	13.0 mv	
9 5/8"	40.0	332	51 mv	1.8 mv	6.8 mv	15 feet
	43.5			2.2 mv	8.5 mv	
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10 3/4"	40.5	352	48 mv	1.2 mv	5.1 mv	18 feet
	45.5			1.8 mv	6.5 mv	
	48.0			2.1 mv	7.6 mv	
	51.0			2.5 mv	8.0 mv	
	54.0			2.7 mv	8.4 mv	
55.5	2.8 mv	8.8 mv				

OTHER LOG TYPES





Radioactive Tracer Survey (RTS) – used to detect RA “tagged” fluid movement through channels behind casing while on injection.

Also used for locating other RA “tagged” material such as proppant, frac fluid, gravel pack, cement squeeze, etc.



Temperature Log – in Injection and Mining, we sometimes use this log to detect top of cement in larger heavier casings.

May also used to locate channels behind casing, and to determine the height of stimulation due to acidizing or fracking.



Oxygen Activation Log – used to detect the movement of water and for locating channels.

How to Access DNR Logging Guidelines

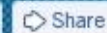
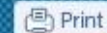
DEPARTMENT OF NATURAL RESOURCES *Scott A. Angelle, Secretary*
STATE OF LOUISIANA

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Text Size:

SONRIS

Database Access
Document Imaging
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Welcome to the Department of Natural Resources

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[State Mineral and Energy Board Holds November Meeting](#)

UPCOMING MEETINGS AND EVENTS

NOV
16

[ABP PUBLIC MEETING](#)



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Coastal Management

OFFICE OF CONSERVATION

The Office of Conservation is charged with conserving and regulating oil, gas, and lignite resources of the state. This statutory responsibility is to regulate the exploration and production of oil, gas and other hydrocarbons and lignite; to control and allocate energy supplies and distribution; and to protect public safety and the environment from oilfield waste, including regulation of underground injection and disposal practices.

The Commissioner of Conservation is responsible for administering all activities involving the conservation and development of all natural and mineral resources of the state. The Commissioner also oversees the administration of six divisions and three district offices within the Office of Conservation.



James "Jim" H. Welsh
Commissioner of Conservation

LATEST NEWS AND EVENTS

- ▶ **[NEW]** Commissioner Extends Emergency Order No. ENV 2011-GW014 (11/3/2011) >>
- ▶ DNR Office of Conservation to Host Series of Ground Water Resources Management Meetings >>

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Coastal Management

CALENDAR

November 2011						
Su	Mo	Tu	We	Th	Fr	Sa
30	31	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26

OFFICE OF CONSERVATION

Forms/Reports/Documents

This page contains links to various Office of Conservation documents of interest to the public, including data, forms, reports, publications, newsletters, and other items.

>> SONRIS	>> Environmental Division	>> Injection & Mining Division
>> Engineering Division	>> Geological Division	>> Pipeline Division

(BACK TO TOP)

SONRIS

FORM	DESCRIPTION			
OGP	Operator's Monthly Oil and Gas Report	Excel		PDF
R2	Transporter's and Storer's Monthly Report			PDF
R3	Refiner's Monthly Report			PDF
R5D	Operator's Monthly Gas Disposition Report	Excel		PDF
R5T	Natural Gas Transporter's Monthly Report			PDF
R6	Gasoline and/or Cycling Plant Monthly Report			PDF
R-A	Part 1 Continuation Form (for R2, R3, R5T TAS Reports)			PDF
R-B	Gasoline and/or Cycling Plant Continuation Form			PDF
R-C	Oil and Gas Import/Export Summary			PDF
DT-1	Gas Well Deliverability Test	Excel		PDF
	Gas Well Deliverability Test (Instructions)			PDF

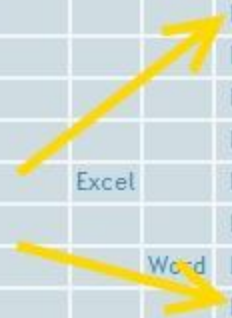
Injection & Mining Division

DESCRIPTION



UIC-1	Class-I Injection Well Application		PDF
UIC-2 SWD	Class-II Injection Well Application	Word	PDF
UIC-2 EOR	Class-II EOR Application		PDF
UIC-2 HSW	Class-II Hydrocarbon Storage Well Application		PDF
UIC-2 COM	Class-II Commercial Injection Well Application		PDF
UIC-2 SFI COM	Class-II Commercial Slurry Fracture Injection Well Application		PDF
UIC-3 BR	Class-III Brine Extraction Well Application	Word	PDF
UIC-4	Class-II Hydrocarbon Storage Inspection Form	CES Use Only	
UIC-5	Class-II Well Integrity Affidavit		PDF
UIC-6	Class-I Well Integrity Affidavit		PDF
UIC-7	Class-II Injection Well Inspection Form	CES Use Only	
UIC-8	Class-I Injection Well Inspection Form	CES Use Only	
UIC-9	Class-II Annular Saltwater Disposal Well Application		PDF
UIC-10A	Annual Disposal/Injection Well Monitoring Report	Word	
	UIC-10A: Source Fluid Attachment	Excel	
	UIC-10A: Report, Attachment, and Instructions		PDF
UIC-11	Mechanical Integrity Noncommercial Class II Daily Monitor Log		PDF
UIC-13	Community Saltwater Disposal System Initial Notification	Word	PDF
UIC-14	Application for Annular Disposal of Reserve Pit Fluids	Word	PDF
UIC-17	Injection Well Work Permit		PDF
UIC-24	Class-I Quarterly Report		PDF
UIC-25	Class-V Well Application		PDF
UIC-30	Work permit to Plug & Abandon a Well utilized for NORM disposal		PDF
UIC-32	Class-II Injection Well Application to Change Disposal/Injection Zone	Word	PDF
UIC-33	Class-III Quarterly Report (Form QR-3)		PDF
UIC-34	Class-III Daily Pressure Monitor Log (Form MIT-3)		PDF
UIC-36	Injection Pressure & Rate Monitoring Log		PDF
UIC-38	Class-III Brine Well Inspection Form	CES Use Only	
UIC-39	Inspection Narrative Form	CES Use Only	
UIC-42	Class-V Well History and Work Resume Report		PDF

RTS-PIT	RTS: Guidelines & Procedures for Annular Disposal of Pit Fluids			PDF
RTS-ANN	RTS: Guidelines & Procedures for Annular Saltwater Disposal Wells			PDF
RTS-T&P	RTS: Guidelines & Procedures for Disposal Wells Completed w/Tubing and Packer			PDF
RTS-PKR	RTS: Guidelines & Procedures for Packerless Disposal Wells			PDF
RTS-TDS	RTS: Time Drive Supplement			PDF
RTS-LOG	RTS: Log Sheet			PDF
OR-1	Organizational Report		Excel	PDF
WH-1	Well History and Work Resume Report			PDF
P&A	Plug and Abandon Report		Word	PDF
CBL	Cement Bond Logging Guidelines			PDF
CSG-T	Affidavit of Test of Casing in Well		Word	PDF
CSG-TSC	Affidavit of Casing Test for Salt Cavern Wells		Word	



Ready for an example?

*****For each of the following examples, for ease, ASSUME that all open-hole logs and CBLs correlate perfectly!*****

- First, you will see the proposed information such as USDW, zone and perforations;**
- Next, you will see the CBL Interpretation Guide;**
- Then, the open-hole log showing the zone;**
- Finally, the CBL Free-Pipe Section and the CBL showing the TOZ and BOZ.**

Essential info to keep in mind:

USDW: 300ft

Surface Casing: 16" (84 #/ft) @ 500 ft

Long String: 10-3/4" (40.5 #/ft) @ 2000 ft

Proposed Zone: 1276 – 1326 ft

How many feet of isolating cement do we need for:

TOZ: ?

BOZ: ?

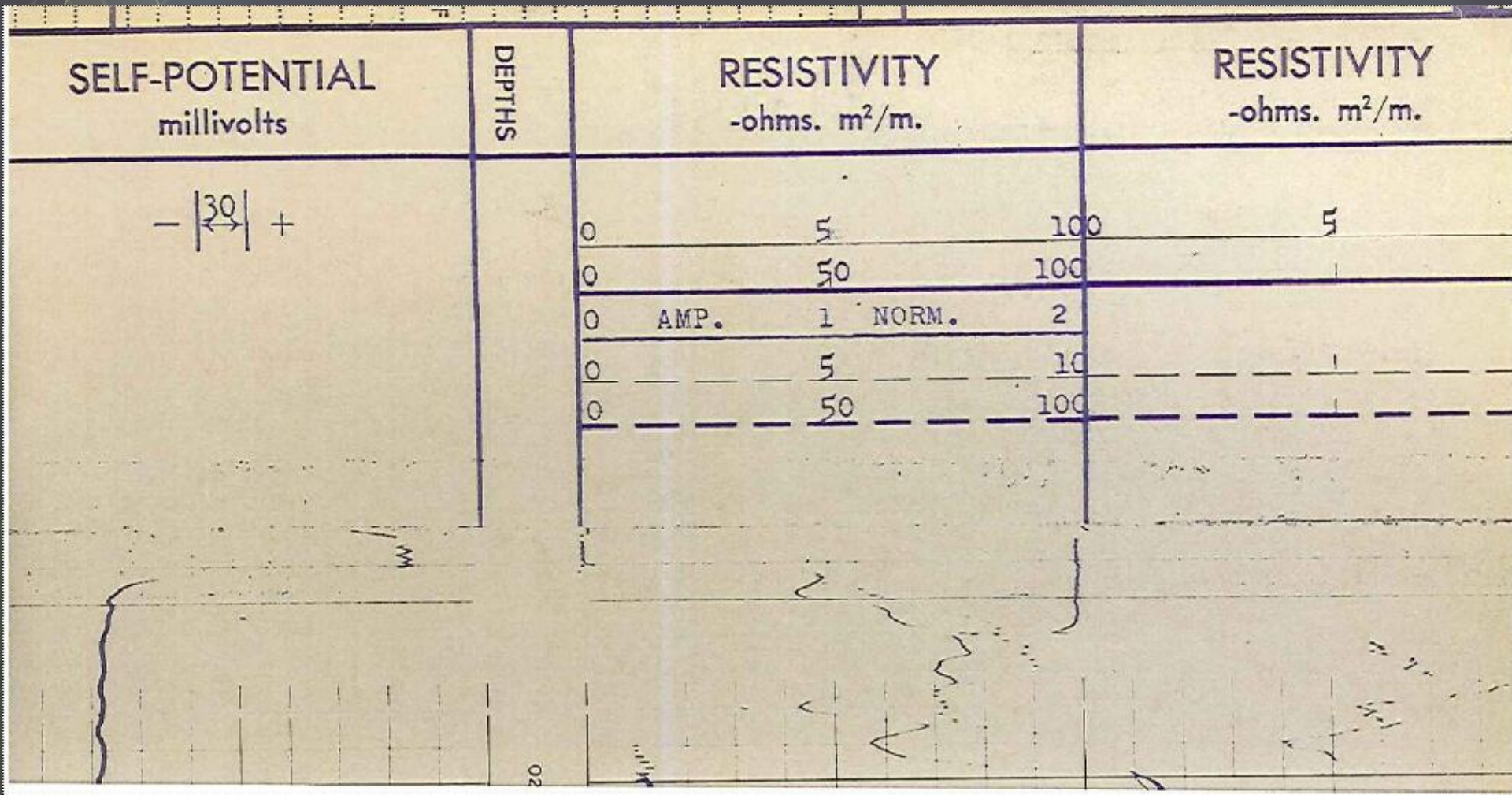
Where would you call the bottom of the required cement interval?

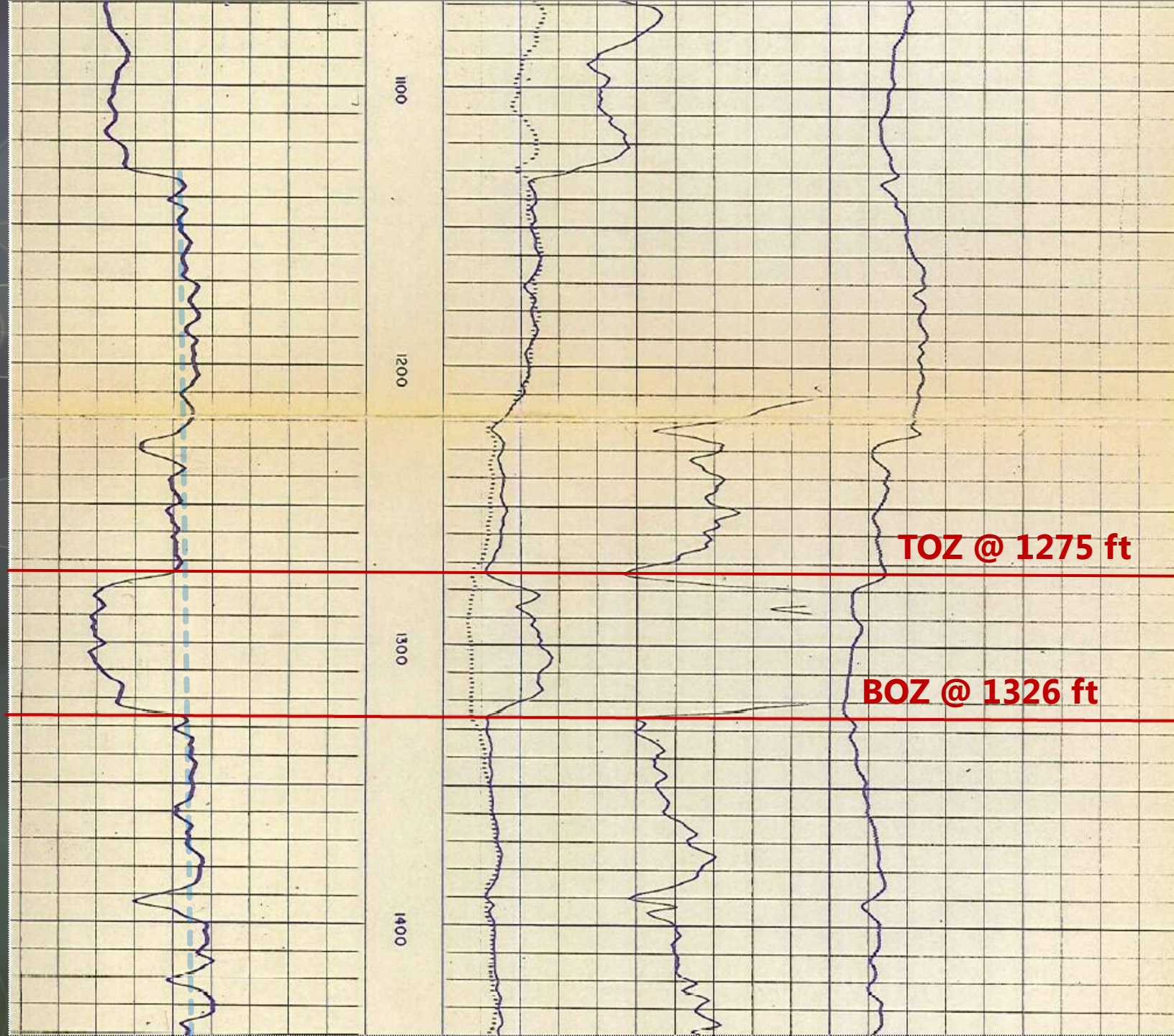
Where is the shallowest allowed packer depth?

Recall this CBL Interpretation Guide:

Cement Bond Log Interpretation Guide						
Casing Size	Weight	Travel Time μ -sec	Free Pipe Signal	Class H Cement		Interval for Isolation
				3000 psi 100% cmt	60% bond cut off	
4 1/2"	9.5	254	81 mv	0.2 mv	2.3 mv	5 feet
	11.6			0.6mv	4.6 mv	
	13.5			1.0 mv	7.0 mv	
5"	15.0	258	76 mv	0.9 mv	5.5 mv	5 feet
	18.0			2.2 mv	10.0 mv	
	21.0			3.6 mv	15.0 mv	
5 1/2"	15.5	269	72 mv	0.7 mv	4.8 mv	6 feet
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	20.0			2.1 mv	9.0 mv	
	23.0			3.5 mv	13.0 mv	
7"	23.0	289	62 mv	1.0 mv	5.5 mv	11 feet
	26.0			1.7 mv	7.5 mv	
	29.0			2.4 mv	9.3 mv	
	32.0			3.3 mv	13.0 mv	
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	38.0			5.0 mv	15.0 mv	
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9 5/8"	40.0	332	51 mv	1.8 mv	6.8 mv	15 feet
	43.5			2.2 mv	8.5 mv	
	47.0			2.7 mv	9.0 mv	
	53.5			4.0 mv	12.0 mv	
10 3/4"	40.5	352	48 mv	1.2 mv	5.1 mv	18 feet
	45.5			1.8 mv	6.5 mv	
	48.0			2.1 mv	7.6 mv	
	51.0			2.5 mv	8.0 mv	
	54.0			2.7 mv	8.4 mv	
	55.5			2.8 mv	8.8 mv	

Open-Hole Log scale:





1100

1200

1300

1400

TOZ @ 1275 ft

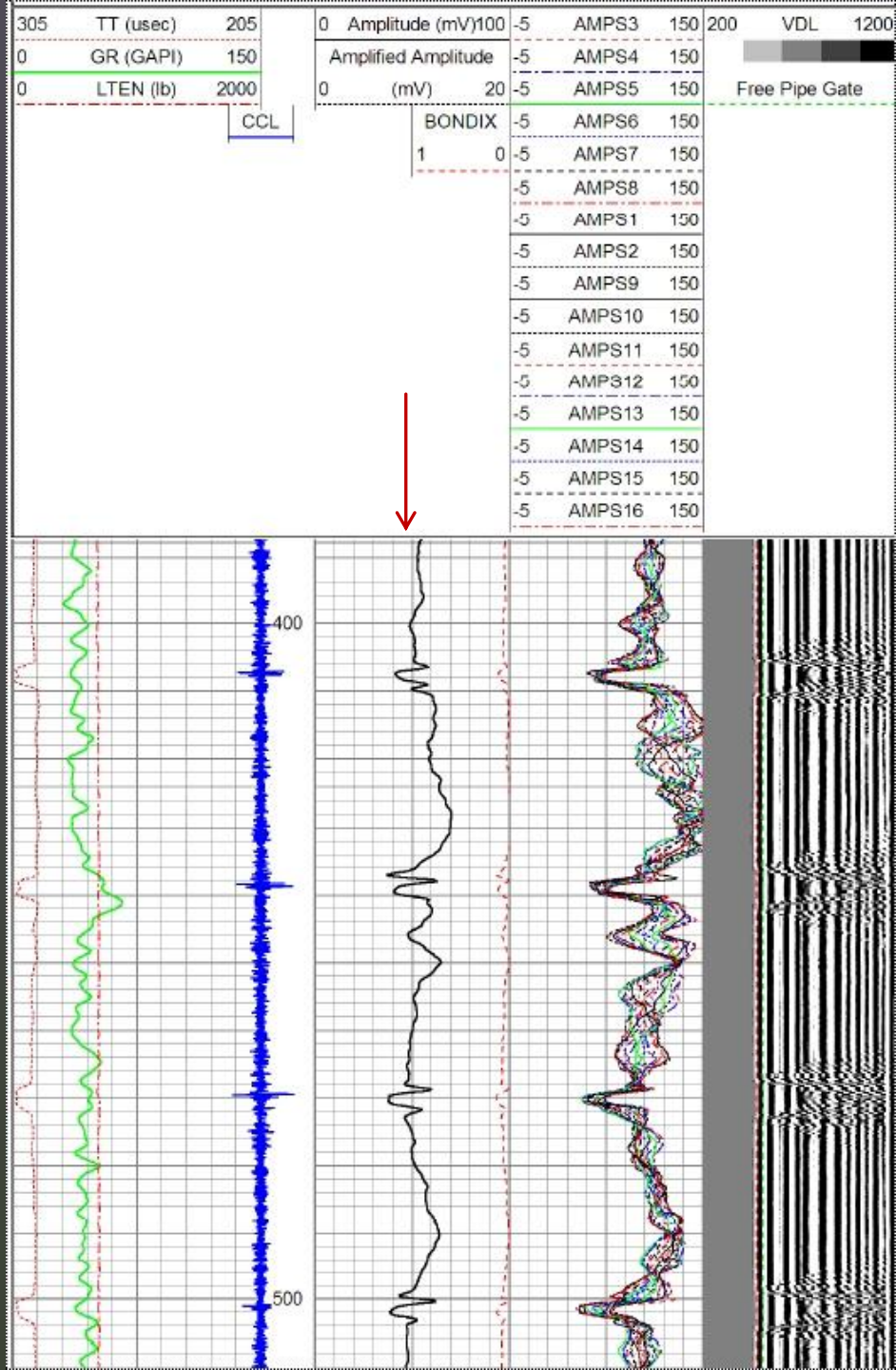
BOZ @ 1326 ft

Recall this CBL Interpretation Guide:

Cement Bond Log Interpretation Guide						
Casing Size	Weight	Travel Time μ -sec	Free Pipe Signal	Class H Cement		Interval for Isolation
				3000 psi 100% cmt	60% bond cut off	
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	51.0			2.5 mv	8.0 mv	
	54.0			2.7 mv	8.4 mv	
	55.5			2.8 mv	8.8 mv	

FREE PIPE SECTION – verifies tool is calibrated:

48mV is considered “free pipe”
(meaning no cement behind the
pipe) for a 10-3/4” casing.



Recall this CBL Interpretation Guide:

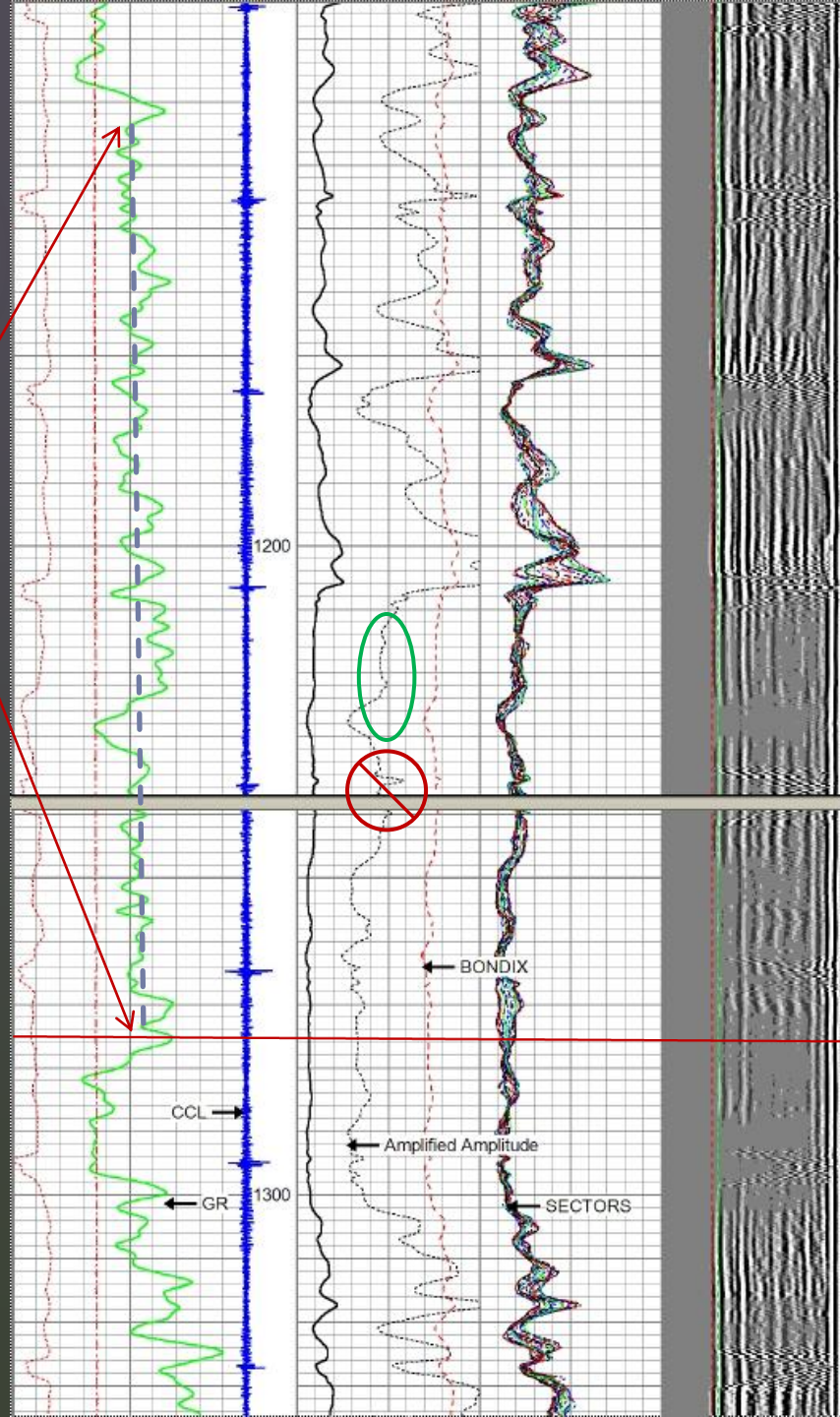
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	51.0			2.5 mv	8.0 mv	
	54.0			2.7 mv	8.4 mv	
	55.5			2.8 mv	8.8 mv	

**Top of Zone (TOZ)
is at 1275 feet:**

**Continuous confining
shale runs from
1134 – 1275 feet.**

**Start at top of shale and
work your way down until
you find the minimum
required (18') continuous
cement interval.**

**Minimum interval
of continuous
60% bonded
cement runs from
1212 – 1230 ft.**

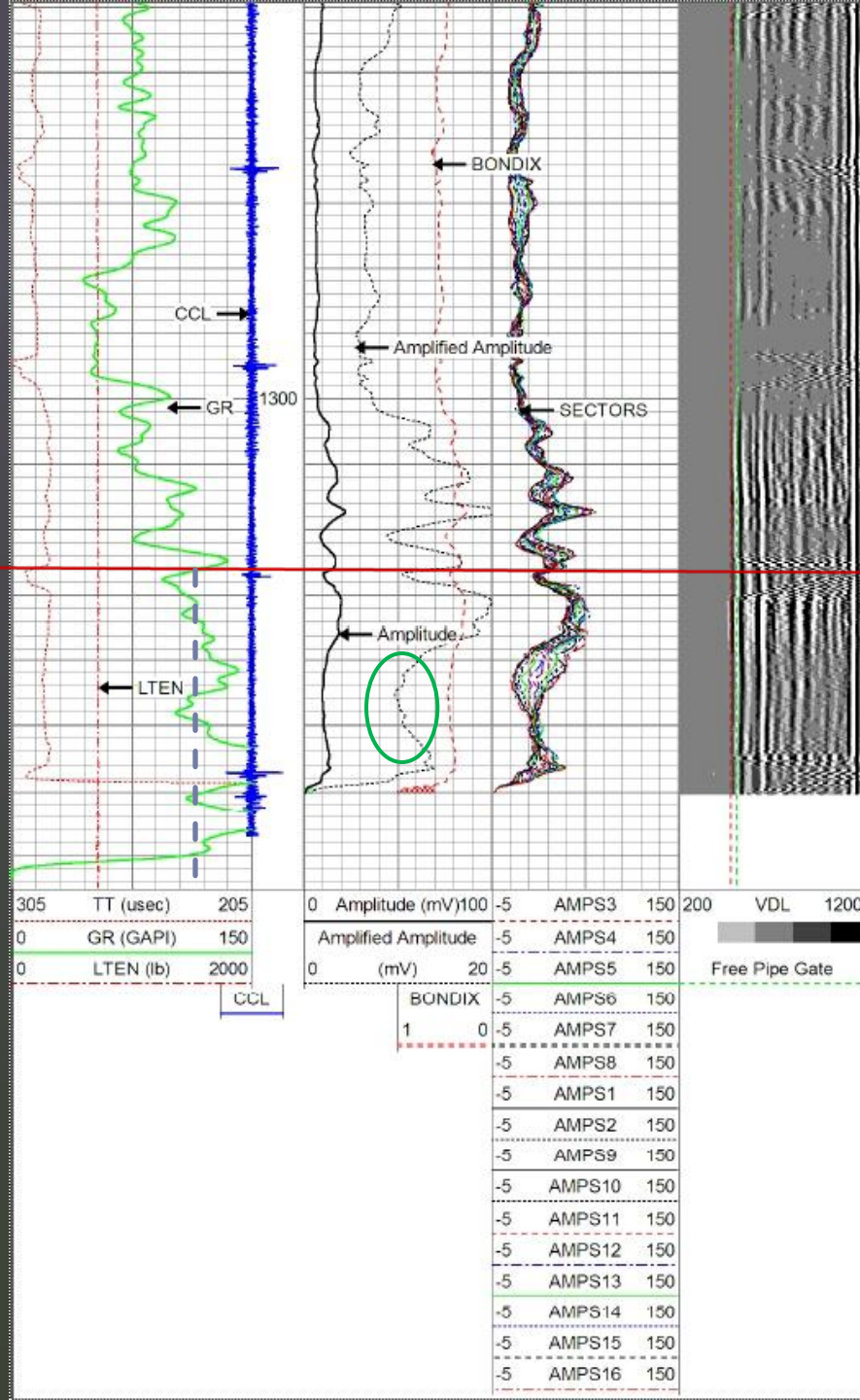


**TOZ @
1275 ft**

Bottom of Zone (BOZ) is at 1326 feet:

BOZ @ 1326 ft

There are "indications of cement" at the BOZ – i.e. not "free pipe".



Your turn to try one!

Essential info to keep in mind:

USDW: 480ft

Surface Casing: 8-5/8" (24 #/ft) @ 815 ft

Long String: 4-1/2" (11.6 #/ft) @ 5045 ft

Proposed Zone: 3020 – 3150 ft

How many feet of isolating cement do we need for:

TOZ: ?

BOZ: ?

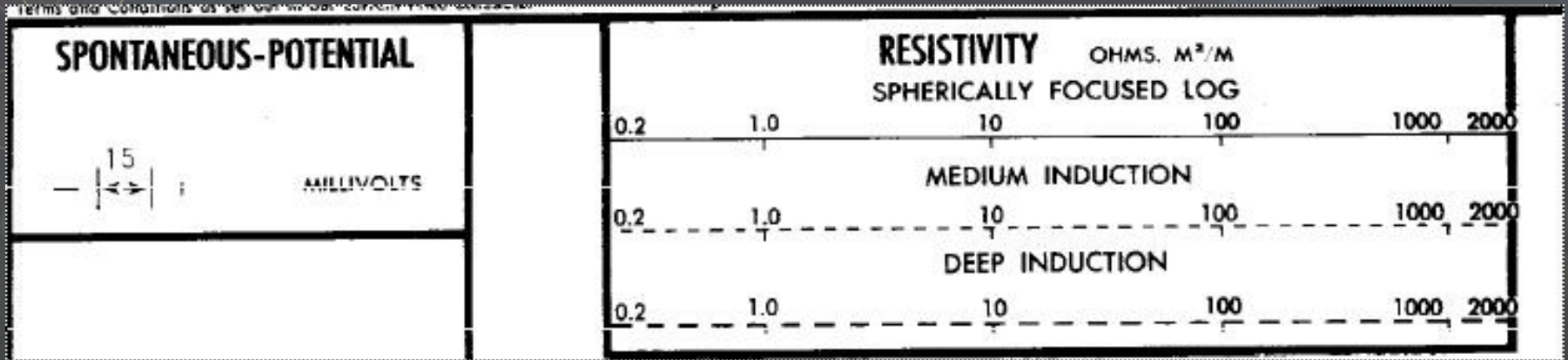
Where would you call the bottom of the required cement interval?

Where is the shallowest allowed packer depth?

Recall this CBL Interpretation Guide:

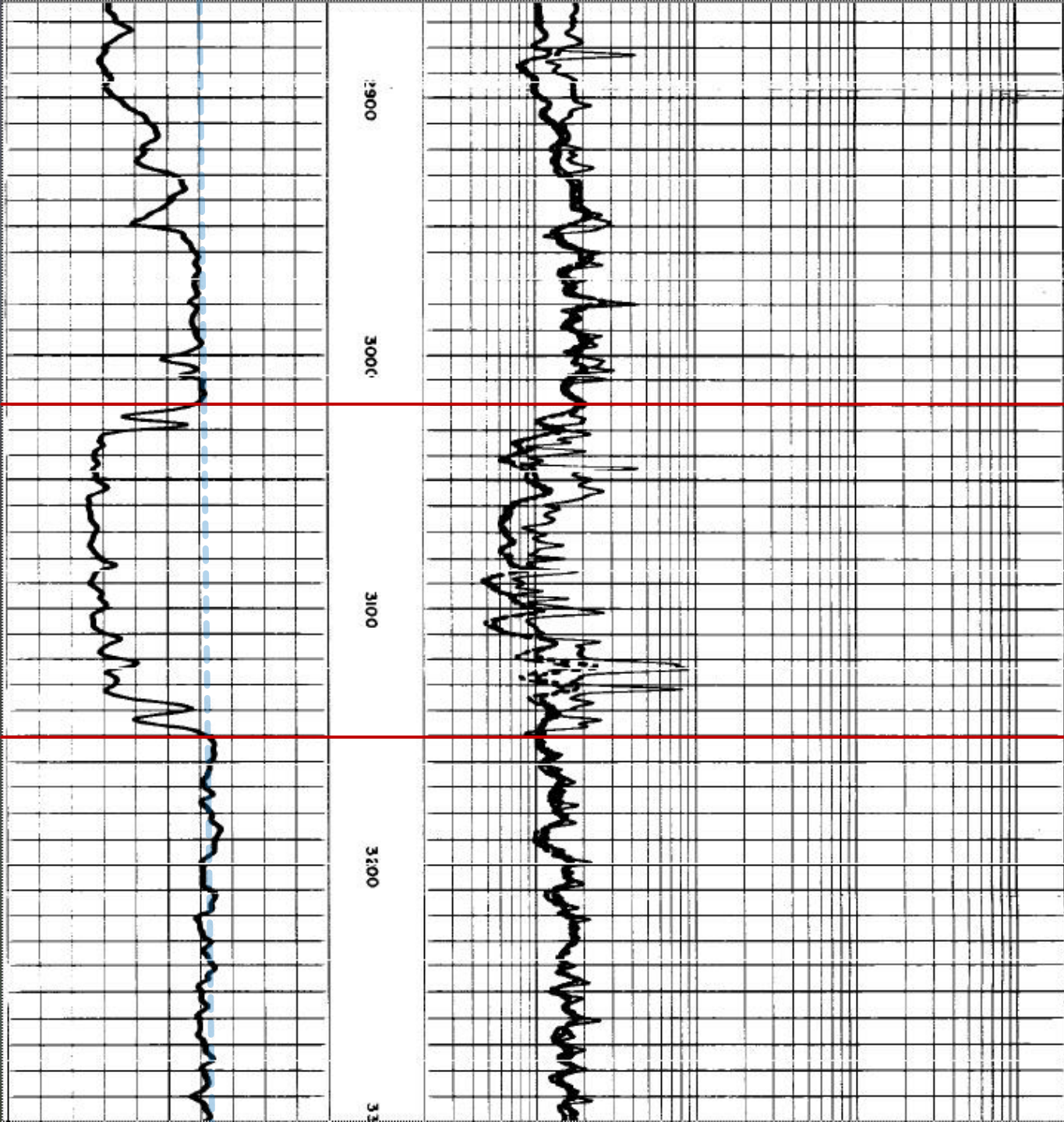
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	54.0			2.7 mv	8.4 mv	
	55.5			2.8 mv	8.8 mv	

Open-Hole Log scale (practice problem #2):



**TOZ @
3020 ft**

**BOZ @
3150 ft**



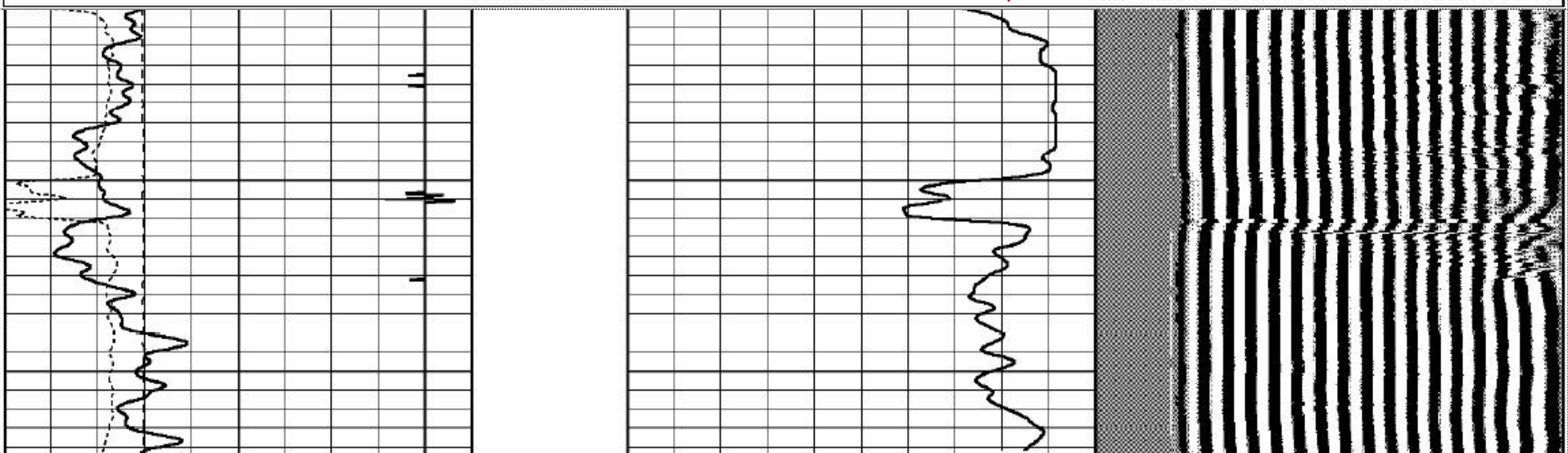
Recall this CBL Interpretation Guide:

Cement Bond Log Interpretation Guide						
Casing Size	Weight	Travel Time μ -sec	Free Pipe Signal	Class H Cement		Interval for Isolation
				3000 psi 100% cmt	60% bond cut off	
4 1/2"	9.5	254	81 mv	0.2 mv	2.3 mv	5 feet
	11.6			0.6mv	4.6 mv	
	13.5			1.0 mv	7.0 mv	
5"	15.0	258	76 mv	0.9 mv	5.5 mv	5 feet
	18.0			2.2 mv	10.0 mv	
	21.0			3.6 mv	15.0 mv	
5 1/2"	15.5	269	72 mv	0.7 mv	4.8 mv	6 feet
	17.0			1.0 mv	5.0 mv	
	20.0			2.1 mv	9.0 mv	
	23.0			3.5 mv	13.0 mv	
7"	23.0	289	62 mv	1.0 mv	5.5 mv	11 feet
	26.0			1.7 mv	7.5 mv	
	29.0			2.4 mv	9.3 mv	
	32.0			3.3 mv	13.0 mv	
	35.0			4.0 mv	14.0 mv	
	40.0			6.0 mv	17.0 mv	
7 5/8"	26.4	302	59 mv	1.1 mv	5.5 mv	12 feet
	29.7			1.8 mv	7.5 mv	
	33.7			2.5 mv	10.0 mv	
	39.0			3.5 mv	13.0 mv	
9 5/8"	40.0	332	51 mv	1.8 mv	6.8 mv	15 feet
	43.5			2.2 mv	8.5 mv	
	47.0			2.7 mv	9.0 mv	
	53.5			4.0 mv	12.0 mv	
10 3/4"	40.5	352	48 mv	1.2 mv	5.1 mv	18 feet
	45.5			1.8 mv	6.5 mv	
	48.0			2.1 mv	7.6 mv	
	51.0			2.5 mv	8.0 mv	
	55.5			2.8 mv	8.8 mv	

FREE PIPE SECTION – verifies tool is calibrated:

81mV is considered “free pipe”
(meaning no cement behind the
pipe) for a 4-1/2” casing.

0	Gamma Ray (GAPI)	150	0	Amplitude X10 (mV)	10	200	VARIABLE DENSITY	1200
-9	CCL	1	0	AMPLITUDE (mV)	100			
0	LINE TENSION (lb)	2500		TEMP				
280	TRAVEL TIME (usec)	180		(degF)				



Recall this CBL Interpretation Guide:

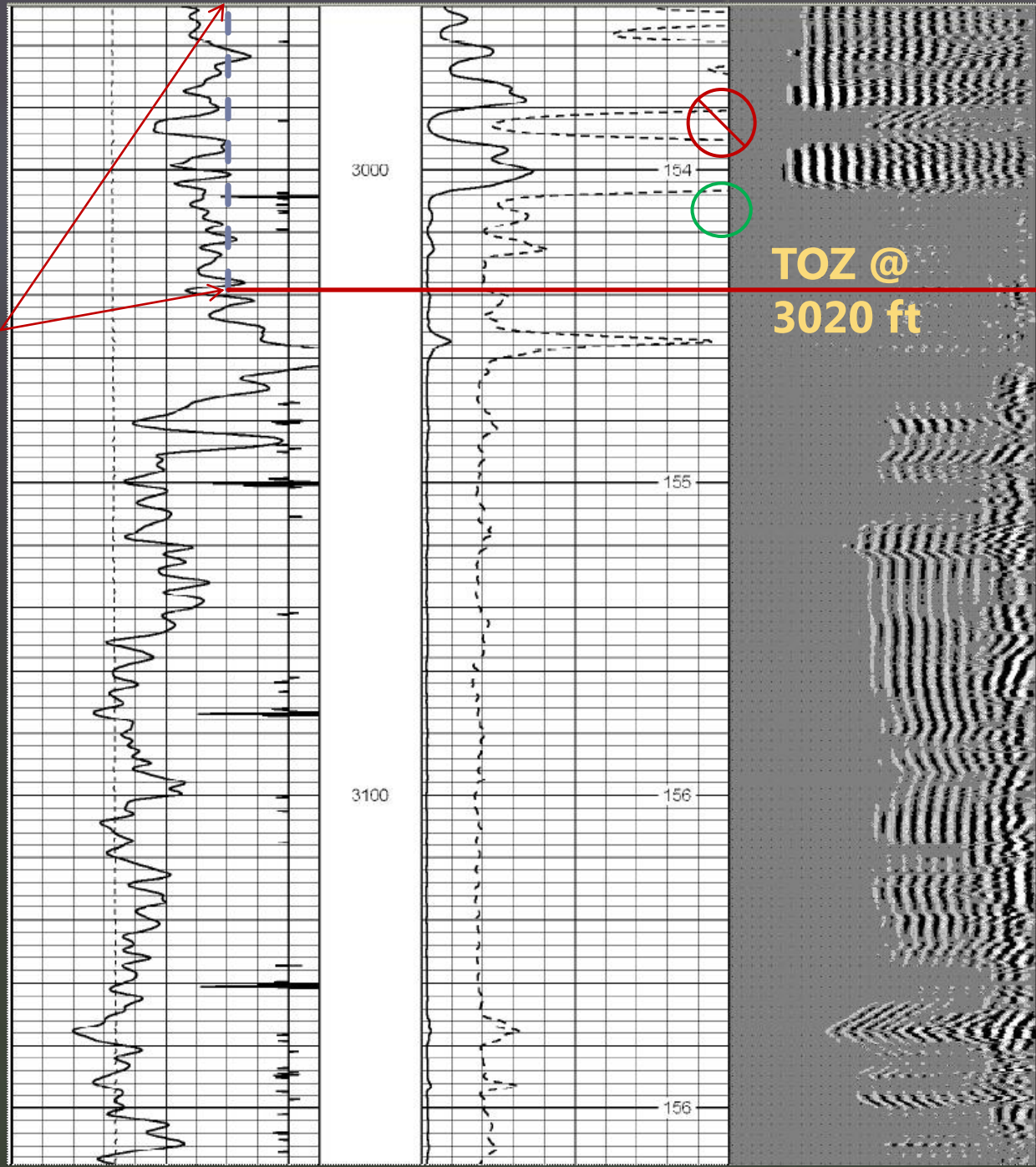
Cement Bond Log Interpretation Guide						
Casing Size	Weight	Travel Time μ -sec	Free Pipe Signal	Class H Cement		Interval for Isolation
				3000 psi 100% cmt	60% bond cut off	
4 1/2"	9.5	254	81 mv	0.2 mv	2.3 mv	5 feet
	11.6			0.6mv	4.6 mv	
	13.5			1.0 mv	7.0 mv	
5"	15.0	258	76 mv	0.9 mv	5.5 mv	5 feet
	18.0			2.2 mv	10.0 mv	
	21.0			3.6 mv	15.0 mv	
5 1/2"	15.5	269	72 mv	0.7 mv	4.8 mv	6 feet
	17.0			1.0 mv	5.0 mv	
	20.0			2.1 mv	9.0 mv	
	23.0			3.5 mv	13.0 mv	
7"	23.0	289	62 mv	1.0 mv	5.5 mv	11 feet
	26.0			1.7 mv	7.5 mv	
	29.0			2.4 mv	9.3 mv	
	32.0			3.3 mv	13.0 mv	
	35.0			4.0 mv	14.0 mv	
	38.0			5.0 mv	15.0 mv	
7 5/8"	26.4	302	59 mv	1.1 mv	5.5 mv	12 feet
	29.7			1.8 mv	7.5 mv	
	33.7			2.5 mv	10.0 mv	
	39.0			3.5 mv	13.0 mv	
9 5/8"	40.0	332	51 mv	1.8 mv	6.8 mv	15 feet
	43.5			2.2 mv	8.5 mv	
	47.0			2.7 mv	9.0 mv	
	53.5			4.0 mv	12.0 mv	
10 3/4"	40.5	352	48 mv	1.2 mv	5.1 mv	18 feet
	45.5			1.8 mv	6.5 mv	
	48.0			2.1 mv	7.6 mv	
	51.0			2.5 mv	8.0 mv	
	54.0			2.7 mv	8.4 mv	
55.5	2.8 mv	8.8 mv				

**Top of Zone (TOZ)
is at 3020 feet:**

**Continuous confining
shale runs from
2960 – 3020 feet.**

**Start at top of shale and
work your way down until
you find the minimum
required (5') continuous
cement interval.**

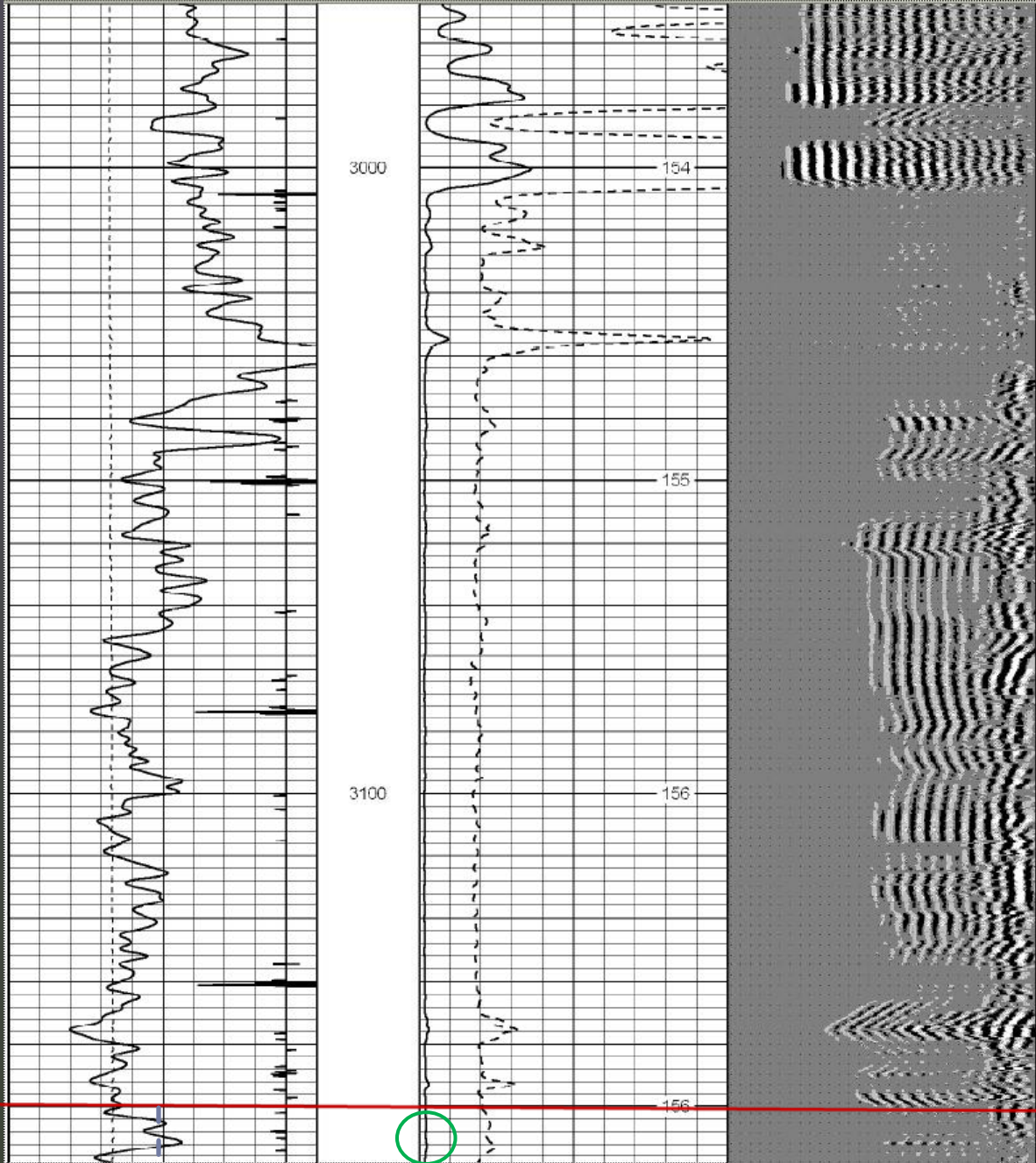
**Minimum interval
of continuous
60% bonded
cement runs from
3004 – 3009 ft.**



Bottom of Zone (BOZ) is at 3150 feet:

There are plenty of
“indications of cement”
at the BOZ – i.e. not
“free pipe”.

BOZ @ 3150 ft



Let's try another one!

Essential info to keep in mind:

USDW: 500 ft

Surface Casing: 9-5/8" (36 #/ft) @ 975 ft

Long String: 7-5/8" (26.4 #/ft) @ 3500 ft

Proposed Zone: 2780 - 2960 ft

How many feet of isolating cement do we need for:

TOZ: ?

BOZ: ?

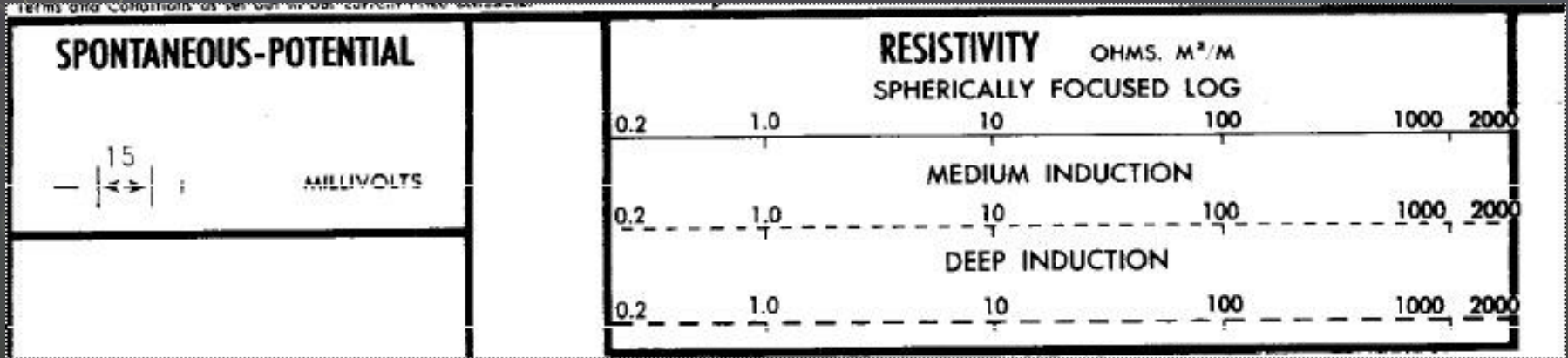
Where would you call the bottom of the required cement interval?

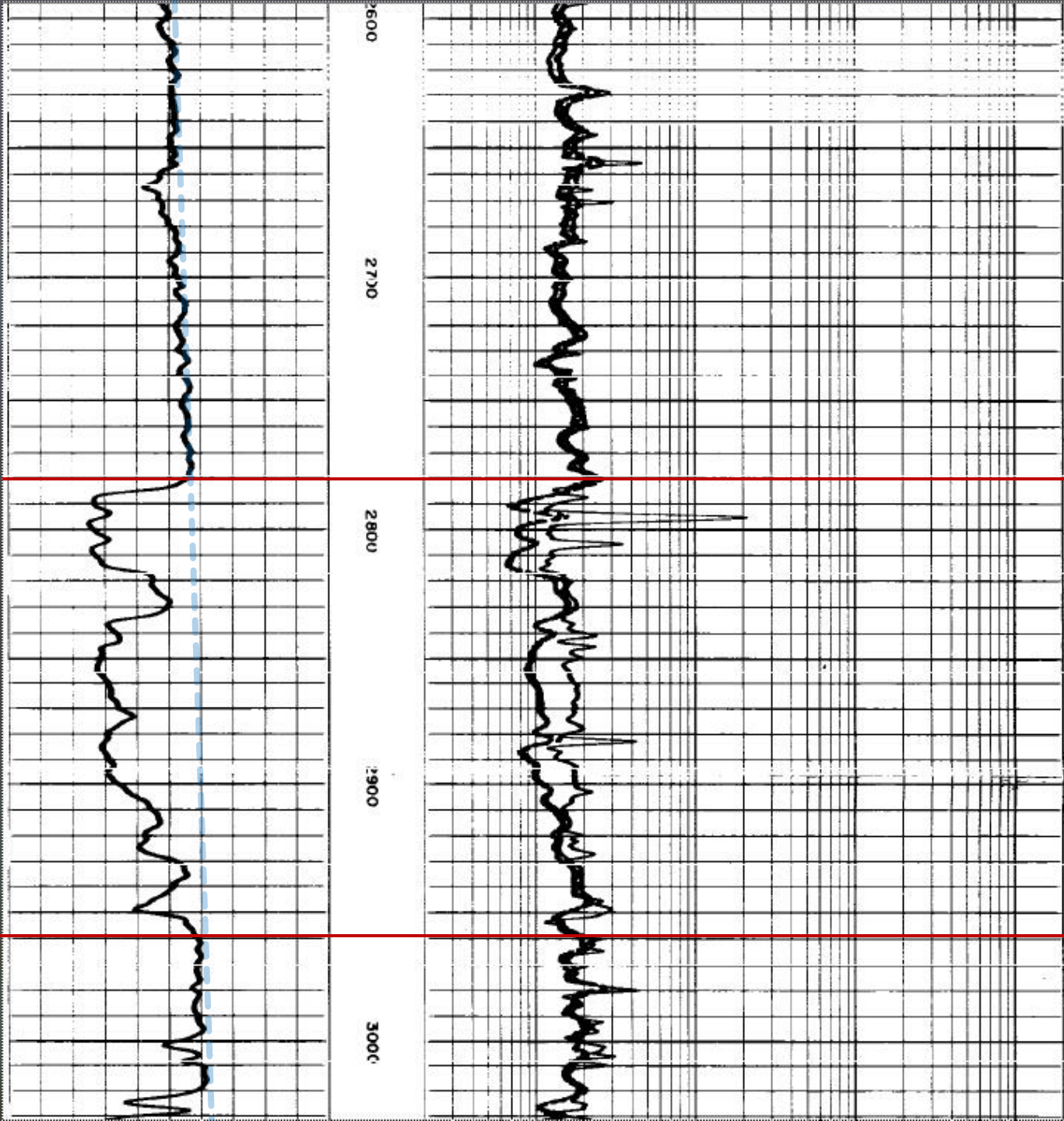
Where is the shallowest allowed packer depth?

Recall this CBL Interpretation Guide:

Cement Bond Log Interpretation Guide						
Casing Size	Weight	Travel Time μ -sec	Free Pipe Signal	Class H Cement		Interval for Isolation
				3000 psi 100% cmt	60% bond cut off	
4 1/2"	9.5	254	81 mv	0.2 mv	2.3 mv	5 feet
	11.6			0.6mv	4.6 mv	
	13.5			1.0 mv	7.0 mv	
5"	15.0	258	76 mv	0.9 mv	5.5 mv	5 feet
	18.0			2.2 mv	10.0 mv	
	21.0			3.6 mv	15.0 mv	
5 1/2"	15.5	269	72 mv	0.7 mv	4.8 mv	6 feet
	17.0			1.0 mv	5.0 mv	
	20.0			2.1 mv	9.0 mv	
	23.0			3.5 mv	13.0 mv	
7"	23.0	289	62 mv	1.0 mv	5.5 mv	11 feet
	25.0			1.7 mv	7.5 mv	
	29.0			2.4 mv	9.3 mv	
	32.0			3.3 mv	13.0 mv	
	35.0			4.0 mv	14.0 mv	
	38.0			5.0 mv	15.0 mv	
7 5/8"	26.4	302	59 mv	1.1 mv	5.5 mv	12 feet
	29.7			1.8 mv	7.5 mv	
	33.7			2.6 mv	10.0 mv	
	39.0			3.5 mv	13.0 mv	
9 5/8"	40.0	332	51 mv	1.8 mv	6.8 mv	15 feet
	43.5			2.2 mv	8.5 mv	
	47.0			2.7 mv	9.0 mv	
	53.5			4.0 mv	12.0 mv	
10 3/4"	40.5	352	46 mv	1.2 mv	5.1 mv	18 feet
	45.5			1.8 mv	6.5 mv	
	48.0			2.1 mv	7.6 mv	
	51.0			2.5 mv	8.0 mv	
	54.0			2.7 mv	8.4 mv	
55.5	2.8 mv	8.8 mv				

Open-Hole Log scale (practice problem #3):





**TOZ @
2780 ft**

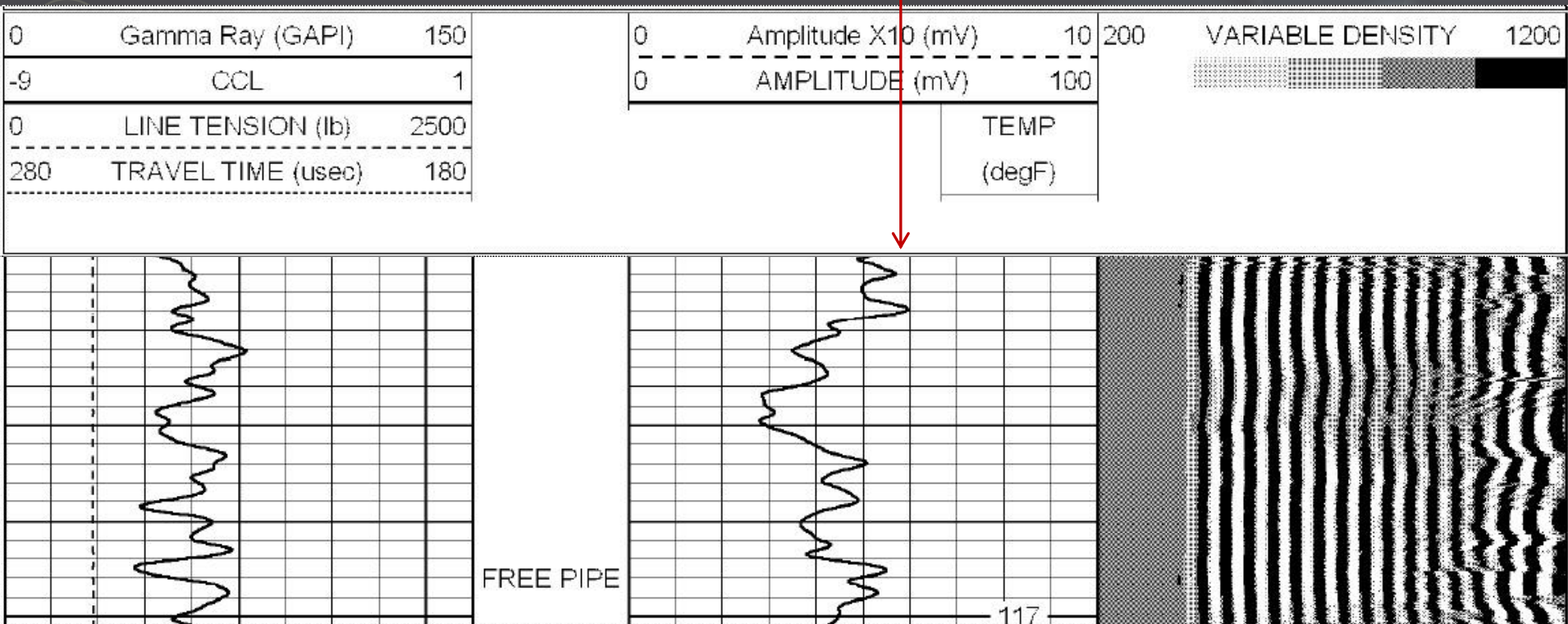
**BOZ @
2960 ft**

Recall this CBL Interpretation Guide:

Cement Bond Log Interpretation Guide						
Casing Size	Weight	Travel Time μ -sec	Free Pipe Signal	Class H Cement		Interval for Isolation
				3000 psi 100% cmt	60% bond cut off	
4 1/2"	9.5	254	81 mv	0.2 mv	2.3 mv	5 feet
	11.6			0.6mv	4.6 mv	
	13.5			1.0 mv	7.0 mv	
5"	15.0	258	76 mv	0.9 mv	5.5 mv	5 feet
	18.0			2.2 mv	10.0 mv	
	21.0			3.6 mv	15.0 mv	
5 1/2"	15.5	269	72 mv	0.7 mv	4.8 mv	6 feet
	17.0			1.0 mv	5.0 mv	
	20.0			2.1 mv	9.0 mv	
	23.0			3.5 mv	13.0 mv	
7"	23.0	289	62 mv	1.0 mv	5.5 mv	11 feet
	25.0			1.7 mv	7.5 mv	
	29.0			2.4 mv	9.3 mv	
	32.0			3.3 mv	13.0 mv	
	35.0			4.0 mv	14.0 mv	
	38.0			5.0 mv	15.0 mv	
7 5/8"	26.4	302	59 mv	1.1 mv	5.5 mv	12 feet
	29.7			1.8 mv	7.5 mv	
	33.7			2.6 mv	10.0 mv	
	39.0			3.5 mv	13.0 mv	
9 5/8"	40.0	332	51 mv	1.8 mv	6.8 mv	15 feet
	43.5			2.2 mv	8.5 mv	
	47.0			2.7 mv	9.0 mv	
	53.5			4.0 mv	12.0 mv	
10 3/4"	40.5	352	46 mv	1.2 mv	5.1 mv	18 feet
	45.5			1.8 mv	6.5 mv	
	48.0			2.1 mv	7.6 mv	
	51.0			2.5 mv	8.0 mv	
	54.0			2.7 mv	8.4 mv	
55.5	2.8 mv	8.8 mv				

FREE PIPE SECTION – verifies tool is calibrated:

59mV is considered “free pipe”
(meaning no cement behind the
pipe) for a 7-5/8” casing.



Recall this CBL Interpretation Guide:

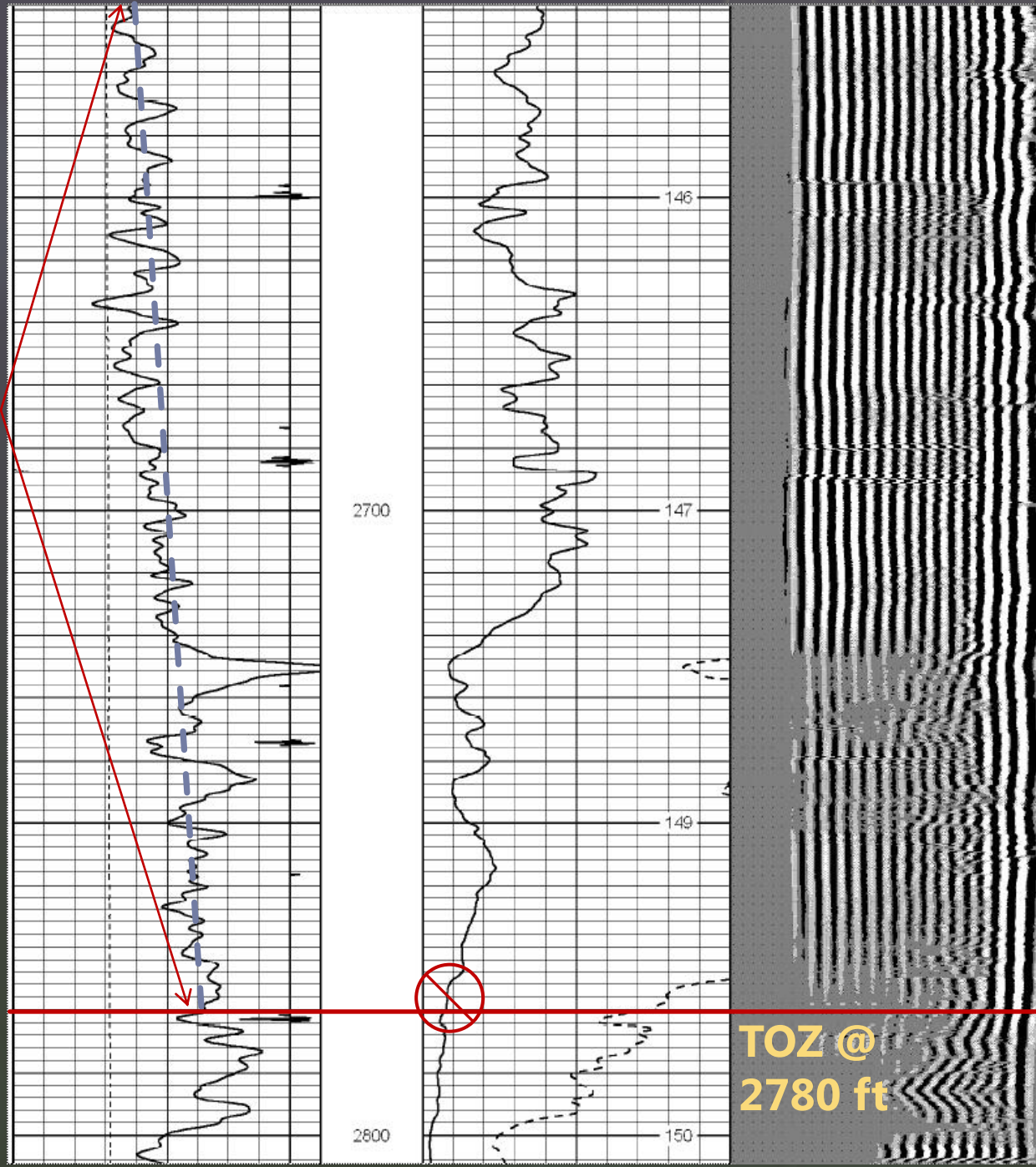
Cement Bond Log Interpretation Guide						
Casing Size	Weight	Travel Time μ -sec	Free Pipe Signal	Class H Cement		Interval for Isolation
				3000 psi 100% cmt	60% bond cut off	
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	11.6			0.6mv	4.6 mv	
	13.5			1.0 mv	7.0 mv	
5"	15.0	258	76 mv	0.9 mv	5.5 mv	5 feet
	18.0			2.2 mv	10.0 mv	
	21.0			3.6 mv	15.0 mv	
5 1/2"	15.5	269	72 mv	0.7 mv	4.8 mv	6 feet
	17.0			1.0 mv	5.0 mv	
	20.0			2.1 mv	9.0 mv	
	23.0			3.5 mv	13.0 mv	
7"	23.0	289	62 mv	1.0 mv	5.5 mv	11 feet
	25.0			1.7 mv	7.5 mv	
	29.0			2.4 mv	9.3 mv	
	32.0			3.3 mv	13.0 mv	
	35.0			4.0 mv	14.0 mv	
	38.0			5.0 mv	15.0 mv	
7 5/8"	26.4	302	59 mv	1.1 mv	5.5 mv	12 feet
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	33.7			2.6 mv	10.0 mv	
	39.0			3.5 mv	13.0 mv	
9 5/8"	40.0	332	51 mv	1.8 mv	6.8 mv	15 feet
	43.5			2.2 mv	8.5 mv	
	47.0			2.7 mv	9.0 mv	
	53.5			4.0 mv	12.0 mv	
10 3/4"	40.5	352	46 mv	1.2 mv	5.1 mv	18 feet
	45.5			1.8 mv	6.5 mv	
	48.0			2.1 mv	7.6 mv	
	51.0			2.5 mv	8.0 mv	
	54.0			2.7 mv	8.4 mv	
55.5	2.8 mv	8.8 mv				

**Top of Zone (TOZ)
is at 2780 feet:**

**Continuous confining
shale runs from
2585 – 2780 feet.**

**Start at top of shale and
work your way down until
you find the minimum
required (12') continuous
cement interval.**

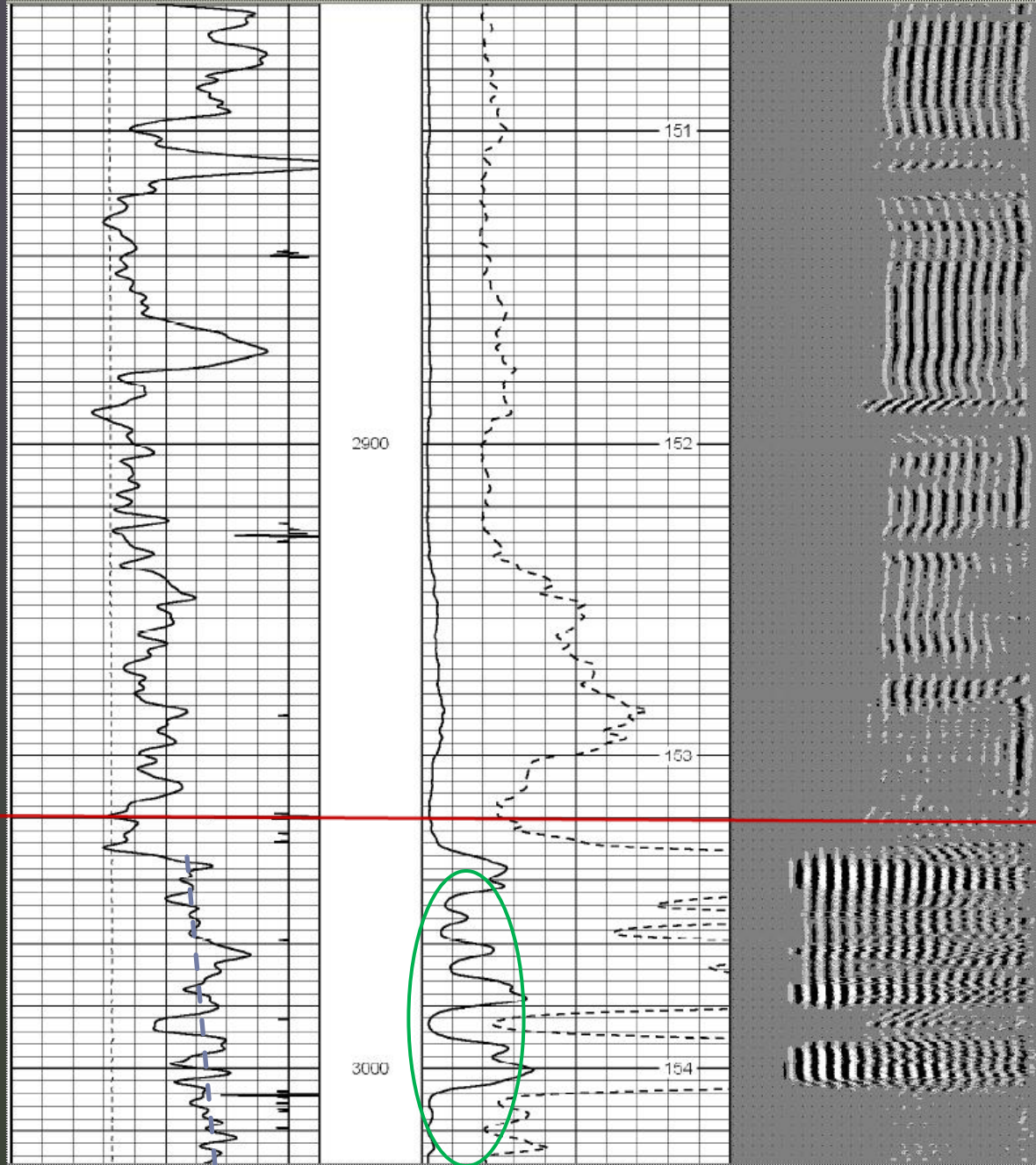
**Minimum interval
of continuous
60% bonded
cement does not exist.
Must perf/squeeze/CBL.**



Bottom of Zone (BOZ) is at 2960 feet:

BOZ @ 2960 ft

There are plenty of
“indications of cement”
at the BOZ – i.e. not
“free pipe”.



The background of the slide is a dark, gradient color transitioning from a deep blue at the top to a dark green at the bottom. It is decorated with numerous overlapping circles of varying sizes and colors, including shades of blue, green, and yellow, creating a bokeh or bubble effect.

Questions?