Transcript of the Testimony of

## **JOHN FRAZIER**

November 29, 2022

AUGUST J. LEVERT, JR. FAMILY, LLC, ET AL v. BP AMERICA PRODUCTION COMPANY



P.O. Box 1554 • Hammond • Louisiana 70404 (Toll Free) 866.870.7233 • 985.542.8685 • (Fax) 985.419.0799 office@amersonwhite.com • www.amersonwhite.com

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<section-header><text><text><text><text><text><text><text><text><text><text></text></text></text></text></text></text></text></text></text></text></section-header>	A P P E A R A N C E S FOR THE PLAINTIFF, via Zoom: JONES SWANSON HUDDELL & DASCHBACH, LLC GOI Poydras Street Suite 2655 New Orleans, Louisiana 70130 BY: KEVIN E. HUDDELL, ESQ. and JONES SWANSON HUDDELL & DASCHBACH, LLC One American Place JOI Main Street Baton Rouge, Louisiana 70801 BY: JOHN T. ARNOLD, ESQ. FOR THE DEFENDANT, via Zoom: ISKOW & LEWIS, APLC Lafayette, Louisiana 70503 BY: COURT C. VANTASSELL, ESQ. and JOHN S. TROUTMAN, ESQ. BY: COURT C. VANTASSELL, ESQ. and LISKOW & LEWIS, APLC JOHN S. TROUTMAN, ESQ. BY: MARK R. DEETHARDT, ESQ. BY: MARK R. DEETHARDT, ESQ.
1       ALSO PRESENT, via Zoom:         2       Gilley DeLorimier         Videographer         3       Brent Pooler         4       Wade Bryan         Matt Green         5         6         7       *****         8         9         10         11         12         13         14         15         16         17         18         19         20         21         23         24         25	4       1     INDEX       2     EXAMINATION:     PAGE(S):       3     By Mr. Huddell     6       4     6       5     EXHIBITS:       6     Exhibit 1 BP America Production Company's       7     Limited Admission of Environmental Damage       9     Pursuant to La. R.S. 30:29     8       8     Exhibit 2 Expert Report of John R.       9     Frazier, Ph.D., CHP, dated October 14, 2022       2016     17       10     Exhibit 3 Expert Report of John R.       11     Frazier, Ph.D., CHP, dated March 31, 2016       2016     35       13     REPORTER'S PAGE       14     REPORTER'S CERTIFICATE       15     ******       16     ******

Pages 1 to 4



5     6       1     STIPULATION     1       2     It is stipulated and agreed by and     2     Mc VANTASSELL:       3     between all parties that this deposition     3     3       4     is herdy being taken for all purposes,     4     and dohn Toutnam on behalf of BP       5     pursuant to the provisions of the     5     5       6     Louisans Code of Civil Procedure.     6     VIDEOGRAPHER:       7     Stear the witness, please.     *****       8     and signing of the transcript by the     8     *****       9     witness, are heavely waived.     9     DR. JOHN FRAZIER       10     All objections, except those as to the     10     325 Sugarwood Drive.       11     form of the question and the     1     Faragut, Tennesses 37663       12     responsiveness of the answer, are reserved     12     having been duly swom       13     testified as follows:     E X AM IN A TIO N       14     be used in evidence.     14     E X AM IN A TIO N       15     *****     15     BY MR. HUDDELL:       16     VIDEOGRAPHER:     16     Q. Okay. Well, The a little sleepy too, so well - well ray to make this as a possible. The first they represent?       19     Frazier being conducted on Noveember the     19     in			·	
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22       now introduce themselves and the party       22       quick and painless as possible. The first         23       they represent?       23       thing I'd like to do is get you to say         24       MR. HUDDELL:       24         25       Kevin Huddell and John Arnold on       25       A. John Ronald Frazier.         7       7       8         1       Q. How are you currently employed?       1       Yes. I have what he did last time         2       A. I'm self-employed.       2       in tabs. What - what tab are you         3       Q. What's the name of your company?       3       MR. HUDDELL:       0h, Tab I.         6       Q. Okay.       6       VIDEOGRAPHER:       0h, Tab I.         7       A self-employed, sole       7       Tab 1. One moment. Is that what         8       proprietorship.       9       WR. HUDDELL:       WR. HUDDELL:         11       A. 325 Sugarwood Drive, Farragut,       11       NR. HUDDELL:       13         12       Tennessee.       12       screenshot of your folder. But we         13       MR. HUDDELL:       13       Maker egoing to         14       Okay. I'd like to pull up Tab 1,       14       pdf Tab 1. If if not, I can do it.         1	20	29th, 2022, via Zoom, at approximately	20	Q. Okay. Well, I'm a little sleepy
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24       MR. HUDDELL:       24       your full name for the record.         25       Kevin Huddell and John Arnold on       25       A. John Ronald Frazier.         7       7       8         1       Q. How are you currently employed?       1       Yes. I have what he did last time in tabs. What what tab are you looking for?         3       Q. What's the name of your company?       3       100king for?         4       A. I'm not incorporated. It's just       4       MR. HUDDELL:         5        5       0h, Tab I.         6       Q. Okay.       6       VIDEOGRAPHER:         7       Xa. 325 Sugarwood Drive, Farragut,       11       looking at right now is just a         12       Tennessee.       12       screenshot of your conder. But we         13       MR. HUDDELL:       13       we if you can switch it to - to the         14       Okay. Id like to pull up Tab 1,       14       pdf Tab 1. If if not, I can do it.         15       Bill. Do you have that?       15       Okay. This is what we're going to         16       VIDEOGRAPHER:       16       mark as Exhibit 1. This is BP America         17       I'm here today.       17       Production Company's Limited Admission         18	22		22	quick and painless as possible. The first
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	25		2.0	



	9		10
1		1	
1 2	Q. Okay. When would you have first		
	seen this?	2	Q. And are are you familiar with -
3	A. I don't know the when I did.	3	- with where those are located generally
4	Q. Okay. Do you have have you	4	on the property?
5	have you read it?	5	A. Yes.
6	A. Yes.	6	Q. All right. Are you aware of any -
7	Q. Okay.	7	- any are you aware of the presence of
8	A. Yes. I read the submission from -	8	any radiation in Areas 1, 2, or 3 that
9	- prepared by HET.	9	would make the soil or groundwater unfit
10	Q. Okay. If we could look at page	10	for their intended use?
11	four of this, top of page four, paragraph	11	A. No.
12	17, I wanted to ask you a question about	12	MR. VANTASSELL:
13	it. Paragraph 17 says, "Pursuant to the	13	Object to form.
14	provisions of Louisiana Code of Civil	14	A. No.
15	Procedure Article 1563 and Act 312, BP	15	MR. HUDDELL:
16	makes a limited admission of	16	Okay. But what was the objection?
			MR. VANTASSELL:
17	responsibility for environmental damage in	17	It calls to the extent it calls
18	Limited Admission Areas 1, 2, and 3	18	
19	depicted on the attached map, Exhibit A,	19	for a legal conclusion.
20	and described as follows". Do you see	20	BY MR. HUDDELL:
21	that?	21	Q. Are you aware of any the
22	A. Yes.	22	presence of any contaminants, or are you
23	Q. Okay. And then it lists three	23	aware of the presence of any constituents
24	different Limited Admission Areas,	24	of concern from oilfield operations in
25	correct?	25	Limited Area Admission Areas 1, 2, or 3
	11		12
1	that would render either the soil or	1	protecting people and the environment from
2	groundwater unfit for their intended use?	2	high doses of radiation.
3	MR. VANTASSELL:	3	Q. What are the potential risks that
4	Same objection.	4	are posed by the presence of high doses of
5	A. I I can only comment regarding	5	radiation in in people?
6	the the radionuclides. All that I saw	6	A. Well, at very high doses, the
7		7	
8	in the data were for naturally occurring		risks are various health effects from very
	radionuclides unrelated to oil operations.	8	high doses, much higher than you could
9	BY MR. HUDDELL:	9	ever receive from environmental levels
10	Q. Okay. So so the answer is	10	like we have here.
11	is no, you you're not aware of any	11	Q. Okay. And what what are
12	constituents in the soil or groundwater	12	what are those risks? What are some of
13	that would render the soil or groundwater	13	those risks?
14	unfit for their intended uses?	14	A. Well, that's a very, very broad
15	MR. VANTASSELL:	15	question. I've studied a lot of those.
16	Object to form. Mischaracterizes.	16	For very high radiation doses, you can
17	A. I'm not aware of any, because my	17	have cancer causation. Those doses are
18	opinions regarding are only regarding	18	much, much higher than you could ever
19	radionuclides.	19	receive from environmental levels like
20	BY MR. HUDDELL:	20	this. And it have some non-stochastic
21	Q. Okay. So what what is your	21	effects such as radiation burns, but that
22	area of expertise, Dr. Frazier?		
23	A. Health physics. That's the	22	would be from very, very high levels such
		23	as nuclear weapons. But very several
	science of radiation protaction from		
24	science of radiation protection from	24	different type of health effects both
24 25	science of radiation protection from from and and radiation safety, from	24 25	different type of health effects both stochastic and non-stochastic effects.



	10		1.4
	13		14
1	Q. What does stochastic mean?	1	dose that would of from of an
2	A. Well, the the likelihood is	2	exposure to Radium 226 and 228, that would
3	probabilistic and not dependent not as	3	would likely cause cancer?
4	dependent on the radiation dose, but the	4	A. Yes. It's one of the the few
5	likelihood is is probability related.	5	radionuclides that does have a threshold
6	Non-stochastic would be the effect would	6	for health effects that from ingestion
7	be determined by the magnitude of the	7	or inhalation intakes into the body, and -
8	dose. The higher the dose, the worse the	8	- but it's very high, much higher than you
9	effect, such as a radiation burn. And	9	could ever receive from environmental
10	those are effects that you get from very	10	levels here.
11	close proximity to very very large	11	Q. And what is that threshold dose?
12	sources of radiation, external radiation,	12	A. When you say, "dose", it's it
13	or internal radiation for that matter.	13	would be an activity. I I'd have to
14	Q. When we're talking about radiation	14	look that one up, but it's it's
15	in the in the oilfield, what	15	described by a scientist publication at
16	radionuclides are we usually referring to?	16	Argon National Laboratory, and I I
17	A. Radium 226 and Radium 228.	17	don't recall the exact number, but it's of
18	Q. And so chronic exposure to Radium	18	of the order of 50 more than 50
19	226 and and Radium 228, can that lead	19	million picocuries.
20	to the development or causation of cancer?	20	Q. The the Argon paper that you
21	A. Only at very, very high doses from	21	referred to, is that something that is
22	internally deposited materials that would	22	included in your reference materials?
23	be ingested or inhaled. But that's very,	23	A. I'm almost certain it is, but let
24	very high doses.	24	me just check. I have a copy of my expert
25	Q. Is is there a a threshold	25	report in the case, and the the author
			1 2
	15		16
1	15 of the report of that document is	1	16 Q. So it's it's your understanding
1 2		1 2	Q. So it's it's your understanding that exposure to radium does not result in
	of the report of that document is		Q. So it's it's your understanding
2	of the report of that document is Roland I don't I don't see it in my	2	<ul><li>Q. So it's it's your understanding that exposure to radium does not result in leukemia?</li><li>A. Not to my knowledge.</li></ul>
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## JOHN FRAZIER 11/29/2022

1     deposition.     1     Q. What's that?       2     The document was marked for attached to the transcript.)     2     A. I – I dort see it on the page istructure is the interpose is the transcript.)       5     BY MR. HUDDELL:     4     MR. HUDDELL:       6     Q. Do you have a copy of your report.     5     Screen?       7     Mark a copy of your report.     7     VIDEOGRAPHER:       8     A. Yes. I have a copy of them,     9     MR. HUDDELL:       10     of the page, it shows the date there, I     1     10       11     think.     11     BY MR. HUDDELL:     0 (kay,       12     Q. Okay, I – I've noticed that when     11     11       13     I – when I open the pdf of your reports,     13     14       14     over the years, I uses the same     15     A. Yeah. I think the genesis of this       15     the - the title always at – at the top     15     A. Yeah. I think the genesis of this       16     says, "Assessment of Radiological     16     17     for that, that the ath at format, subsequent documents have the same format       21     A. No. I don't know what yourc     16     for that, that the ath at format, subsequent documents have the same format       22     n that swell on your reports?     20     for that, that the ath at modu the inthe of the atroduction, opinions		17		18
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Pages 17 to 20



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1	radiation detector, held near the surface	1	Q. Okay. Now, we if if you
2	of the soil and maneuver move that over	2	if you had found radium isotopes that
3	the soil to see if I get a a gamma	3	indicated the presence of NORM from
4	radiation reading that would exceed the	4	oilfield operations, how would that how
5	natural background gamma radiation reading	5	would that NORM have gotten in the water?
6	in the soil. And then subsequent to a	6	That's a terrible question.
7	survey like that, a radiation survey, if	7	MR. VANTASSELL:
8	there are areas even if they're not	8	Object to form.
9		9	BY MR. HUDDELL:
10	areas elevated, we'd be collecting surface	10	Q. How how can NORM from oilfield
10	soil samples for analysis for	-	
	concentrations of Radium 226 and Radium	11	operations get into the groundwater?
12	228 in the soil.	12	A. Oh okay, from oilfield operations?
13	Q. Okay. But in this case, you	13	Yeah. Actually, in in the produced
14	didn't you didn't go out there and	14	water, the there is various levels of
15	and test the soil for radioactive	15	Radium 226 and 228, depending upon the
16	materials?	16	formation from which the produced water
17	A. That's right. I saw no reason to	17	comes, and that produced water, when
18	do that.	18	released into a pit or out of a well, that
19	Q. Okay. Opinion number two is, the	19	is a a source of Radium 226 and 228
20	ratios of concentrations of radium	20	into the water. But we already have
21	isotopes in the water from all monitoring	21	naturally occurring Radium 226 and 228 in
22	wells are consistent with native soils and	22	water. All all water has Radium 226
23	do not indicate the presence of NORM from	23	and 228 in it.
24	oilfield operations; is that right?	24	Q. Okay. If what what is the
25	A. That is correct.	25	mechanism though by which the the
		1	
	23		24
1	23 groundwater would become contaminated by	1	24 Samples.
1 2		1 2	
	groundwater would become contaminated by		Samples. Q. Okay. And so at looks like at
2	groundwater would become contaminated by oilfield NORM?	2	Samples.
2 3	groundwater would become contaminated by oilfield NORM? MR. VANTASSELL:	2 3	Samples. Q. Okay. And so at looks like at LT-1, there was no testing at the Eberline
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Pages 21 to 24



	25		26
1	use; is that correct?	1	would find for natural Louisiana solids in
2	A. Yes.	2	in the radium in natural Louisiana
3	Q. Okay. Do you consider it a a	3	solids in water.
4	better lab than the Pace Lab or more	4	Q. Okay. So over the years, I've
5	reliable or anything like that?	5	asked you about your your theory of
6		6	of the the ratios indicating being
7	<b>J</b> 1	7	an indicator of whether the NORM is is
	are reputable laboratories.		
8	Q. Okay. All right. And so what	8	is natural or from from produced
9	why did you conclude at LT-1, based on the	9	water, right?
10	Pace Pace Lab results, that the NORM	10	MR. VANTASSELL:
11	that was found in the groundwater was not	11	Object to form.
12	oilfield related?	12	BY MR. HUDDELL:
13	A. Two things. The Radium 228	13	Q. We talked about that several
14	concentration was actually greater than	14	times?
15	the Radium 226, including the	15	MR. VANTASSELL:
16	uncertainties of both. That's the first	16	Object to form.
17	indication that it's not oil-produced	17	A. I wouldn't call it a theory. I
18	water. The second thing is, you're	18	think I'd call it a scientific fact. But
19	looking at the activity concentration per	19	yes, you've asked me before.
20	mass of solids, solids being 18.8 grams	20	BY MR. HUDDELL:
21	per liter, and so, for instance, Radium	21	Q. Okay. And I'm I'm just
22	228 is 3.6 picocuries per liter and that's	22	wondering if if now and on November
23	in a sample that has 18.8 grams per liter.	23	29th, 2022, do you are there any
24	So that's a concentration there of 3.6	24	scientific papers that that talk about
25	divided by 18.8 is within the range you	25	this this ratio analysis that that -
	27		28
1		1 1	combination of of three three on
1	- that you've that you've done?	1	combination of of three three or
2	A. Well, the initial ratios of Radium	2	more factors that we have here.
2 3	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of	2 3	more factors that we have here. Q. Okay. And I was just wondering if
2 3 4	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The	2 3 4	more factors that we have here. Q. Okay. And I was just wondering if there's a a published scientific study
2 3 4 5	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the	2 3 4 5	More factors that we have here. Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that
2 3 4 5 6	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the normal ratio is. It's approximately 1:1	2 3 4 5 6	More factors that we have here. Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that that is a method of determining whether
2 3 4 5 6 7	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the normal ratio is. It's approximately 1:1 in normal soil, a little bit more Radium	2 3 4 5 6 7	More factors that we have here. Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that that is a method of determining whether the radium that's being found in the
2 3 4 5 6 7 8	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the normal ratio is. It's approximately 1:1 in normal soil, a little bit more Radium 228. But we also have the little bit	2 3 4 5 6 7 8	More factors that we have here. Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that that is a method of determining whether the radium that's being found in the groundwater is natural or from or from
2 3 4 5 6 7 8 9	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the normal ratio is. It's approximately 1:1 in normal soil, a little bit more Radium 228. But we also have the little bit higher Radium 228 than 226 in new produced	2 3 4 5 6 7 8 9	More factors that we have here. Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that that is a method of determining whether the radium that's being found in the groundwater is natural or from or from produced water?
2 3 4 5 6 7 8 9 10	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the normal ratio is. It's approximately 1:1 in normal soil, a little bit more Radium 228. But we also have the little bit higher Radium 228 than 226 in new produced water when it's first brought out of the	2 3 4 5 6 7 8 9 10	More factors that we have here. Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that that is a method of determining whether the radium that's being found in the groundwater is natural or from or from produced water? MR. VANTASSELL:
2 3 4 5 6 7 8 9 10 11	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the normal ratio is. It's approximately 1:1 in normal soil, a little bit more Radium 228. But we also have the little bit higher Radium 228 than 226 in new produced water when it's first brought out of the ground. Subsequent to that though, is	2 3 4 5 6 7 8 9 10 11	<ul> <li>More factors that we have here.</li> <li>Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that that is a method of determining whether the radium that's being found in the groundwater is natural or from or from produced water?</li> <li>MR. VANTASSELL: Object to form. Asked and</li> </ul>
2 3 4 5 6 7 8 9 10 11 12	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the normal ratio is. It's approximately 1:1 in normal soil, a little bit more Radium 228. But we also have the little bit higher Radium 228 than 226 in new produced water when it's first brought out of the ground. Subsequent to that though, is that we have the natural radioactive decay	2 3 4 5 6 7 8 9 10 11 12	<ul> <li>More factors that we have here.</li> <li>Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that that is a method of determining whether the radium that's being found in the groundwater is natural or from or from produced water?</li> <li>MR. VANTASSELL: Object to form. Asked and answered.</li> </ul>
2 3 4 5 6 7 8 9 10 11 12 13	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the normal ratio is. It's approximately 1:1 in normal soil, a little bit more Radium 228. But we also have the little bit higher Radium 228 than 226 in new produced water when it's first brought out of the ground. Subsequent to that though, is that we have the natural radioactive decay of both of those because they're taken	2 3 4 5 6 7 8 9 10 11 12 13	<ul> <li>more factors that we have here.</li> <li>Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that that is a method of determining whether the radium that's being found in the groundwater is natural or from or from produced water?</li> <li>MR. VANTASSELL: Object to form. Asked and answered.</li> <li>A. I I don't know of any specific</li> </ul>
2 3 4 5 6 7 8 9 10 11 12 13 14	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the normal ratio is. It's approximately 1:1 in normal soil, a little bit more Radium 228. But we also have the little bit higher Radium 228 than 226 in new produced water when it's first brought out of the ground. Subsequent to that though, is that we have the natural radioactive decay of both of those because they're taken away from their parent, the parents	2 3 4 5 6 7 8 9 10 11 12 13 14	<ul> <li>more factors that we have here.</li> <li>Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that that is a method of determining whether the radium that's being found in the groundwater is natural or from or from produced water?</li> <li>MR. VANTASSELL: Object to form. Asked and answered.</li> <li>A. I I don't know of any specific scientific paper, but I do know that the</li> </ul>
2 3 4 5 6 7 8 9 10 11 12 13 14 15	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the normal ratio is. It's approximately 1:1 in normal soil, a little bit more Radium 228. But we also have the little bit higher Radium 228 than 226 in new produced water when it's first brought out of the ground. Subsequent to that though, is that we have the natural radioactive decay of both of those because they're taken away from their parent, the parents plural. Respectively, that's the the	2 3 4 5 6 7 8 9 10 11 12 13 14 15	<ul> <li>more factors that we have here.</li> <li>Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that that is a method of determining whether the radium that's being found in the groundwater is natural or from or from produced water?</li> <li>MR. VANTASSELL: <ul> <li>Object to form. Asked and answered.</li> <li>A. I I don't know of any specific scientific paper, but I do know that the International Atomic Energy Agency</li> </ul> </li> </ul>
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the normal ratio is. It's approximately 1:1 in normal soil, a little bit more Radium 228. But we also have the little bit higher Radium 228 than 226 in new produced water when it's first brought out of the ground. Subsequent to that though, is that we have the natural radioactive decay of both of those because they're taken away from their parent, the parents plural. Respectively, that's the the parent of Radium 226 is Uranium 238 and	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	<ul> <li>more factors that we have here.</li> <li>Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that that is a method of determining whether the radium that's being found in the groundwater is natural or from or from produced water?</li> <li>MR. VANTASSELL: <ul> <li>Object to form. Asked and answered.</li> <li>A. I I don't know of any specific scientific paper, but I do know that the International Atomic Energy Agency publication, Radium in the Environment,</li> </ul> </li> </ul>
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the normal ratio is. It's approximately 1:1 in normal soil, a little bit more Radium 228. But we also have the little bit higher Radium 228 than 226 in new produced water when it's first brought out of the ground. Subsequent to that though, is that we have the natural radioactive decay of both of those because they're taken away from their parent, the parents plural. Respectively, that's the the parent of Radium 226 is Uranium 238 and the parent of ultimately, the parent of	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	<ul> <li>more factors that we have here.</li> <li>Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that that is a method of determining whether the radium that's being found in the groundwater is natural or from or from produced water?</li> <li>MR. VANTASSELL: <ul> <li>Object to form. Asked and answered.</li> <li>A. I I don't know of any specific scientific paper, but I do know that the International Atomic Energy Agency publication, Radium in the Environment, addresses radium in in groundwater and</li> </ul> </li> </ul>
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the normal ratio is. It's approximately 1:1 in normal soil, a little bit more Radium 228. But we also have the little bit higher Radium 228 than 226 in new produced water when it's first brought out of the ground. Subsequent to that though, is that we have the natural radioactive decay of both of those because they're taken away from their parent, the parents plural. Respectively, that's the the parent of Radium 226 is Uranium 238 and the parent of ultimately, the parent of Radium 228 is Thorium 232. So being taken	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	<ul> <li>more factors that we have here.</li> <li>Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that that is a method of determining whether the radium that's being found in the groundwater is natural or from or from produced water?</li> <li>MR. VANTASSELL: Object to form. Asked and answered.</li> <li>A. I I don't know of any specific scientific paper, but I do know that the International Atomic Energy Agency publication, Radium in the Environment, addresses radium in in groundwater and discusses the isotopic ratios in that.</li> </ul>
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the normal ratio is. It's approximately 1:1 in normal soil, a little bit more Radium 228. But we also have the little bit higher Radium 228 than 226 in new produced water when it's first brought out of the ground. Subsequent to that though, is that we have the natural radioactive decay of both of those because they're taken away from their parent, the parents plural. Respectively, that's the the parent of Radium 226 is Uranium 238 and the parent of ultimately, the parent of Radium 228 is Thorium 232. So being taken away from their parents in in the	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	<ul> <li>more factors that we have here.</li> <li>Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that that is a method of determining whether the radium that's being found in the groundwater is natural or from or from produced water?</li> <li>MR. VANTASSELL: Object to form. Asked and answered.</li> <li>A. I I don't know of any specific scientific paper, but I do know that the International Atomic Energy Agency publication, Radium in the Environment, addresses radium in in groundwater and discusses the isotopic ratios in that. BY MR. HUDDELL:</li> </ul>
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the normal ratio is. It's approximately 1:1 in normal soil, a little bit more Radium 228. But we also have the little bit higher Radium 228 than 226 in new produced water when it's first brought out of the ground. Subsequent to that though, is that we have the natural radioactive decay of both of those because they're taken away from their parent, the parents plural. Respectively, that's the the parent of Radium 226 is Uranium 238 and the parent of ultimately, the parent of Radium 228 is Thorium 232. So being taken away from their parents in in the formation from which the produced water	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	<ul> <li>more factors that we have here.</li> <li>Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that that is a method of determining whether the radium that's being found in the groundwater is natural or from or from produced water?</li> <li>MR. VANTASSELL: Object to form. Asked and answered.</li> <li>A. I I don't know of any specific scientific paper, but I do know that the International Atomic Energy Agency publication, Radium in the Environment, addresses radium in in groundwater and discusses the isotopic ratios in that.</li> <li>BY MR. HUDDELL:</li> <li>Q. Okay. So let's move to sample ID</li> </ul>
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the normal ratio is. It's approximately 1:1 in normal soil, a little bit more Radium 228. But we also have the little bit higher Radium 228 than 226 in new produced water when it's first brought out of the ground. Subsequent to that though, is that we have the natural radioactive decay of both of those because they're taken away from their parent, the parents plural. Respectively, that's the the parent of Radium 226 is Uranium 238 and the parent of ultimately, the parent of Radium 228 is Thorium 232. So being taken away from their parents in in the formation from which the produced water came, they would be following their half	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	<ul> <li>more factors that we have here.</li> <li>Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that that is a method of determining whether the radium that's being found in the groundwater is natural or from or from produced water?</li> <li>MR. VANTASSELL: <ul> <li>Object to form. Asked and answered.</li> <li>A. I I don't know of any specific scientific paper, but I do know that the International Atomic Energy Agency publication, Radium in the Environment, addresses radium in in groundwater and discusses the isotopic ratios in that.</li> <li>BY MR. HUDDELL:</li> <li>Q. Okay. So let's move to sample ID LT-2. What what about these results</li> </ul> </li> </ul>
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the normal ratio is. It's approximately 1:1 in normal soil, a little bit more Radium 228. But we also have the little bit higher Radium 228 than 226 in new produced water when it's first brought out of the ground. Subsequent to that though, is that we have the natural radioactive decay of both of those because they're taken away from their parent, the parents plural. Respectively, that's the the parent of Radium 226 is Uranium 238 and the parent of ultimately, the parent of Radium 228 is Thorium 232. So being taken away from their parents in in the formation from which the produced water came, they would be following their half lives and the Radium 228 concentration	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	<ul> <li>more factors that we have here.</li> <li>Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that that is a method of determining whether the radium that's being found in the groundwater is natural or from or from produced water?</li> <li>MR. VANTASSELL: <ul> <li>Object to form. Asked and answered.</li> </ul> </li> <li>A. I I don't know of any specific scientific paper, but I do know that the International Atomic Energy Agency publication, Radium in the Environment, addresses radium in in groundwater and discusses the isotopic ratios in that.</li> <li>BY MR. HUDDELL:</li> <li>Q. Okay. So let's move to sample ID LT-2. What what about these results shows that this would be natural and not -</li> </ul>
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the normal ratio is. It's approximately 1:1 in normal soil, a little bit more Radium 228. But we also have the little bit higher Radium 228 than 226 in new produced water when it's first brought out of the ground. Subsequent to that though, is that we have the natural radioactive decay of both of those because they're taken away from their parent, the parents plural. Respectively, that's the the parent of Radium 226 is Uranium 238 and the parent of ultimately, the parent of Radium 228 is Thorium 232. So being taken away from their parents in in the formation from which the produced water came, they would be following their half lives and the Radium 228 concentration would continued to decrease faster than	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	<ul> <li>more factors that we have here.</li> <li>Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that that is a method of determining whether the radium that's being found in the groundwater is natural or from or from produced water?</li> <li>MR. VANTASSELL: <ul> <li>Object to form. Asked and answered.</li> </ul> </li> <li>A. I I don't know of any specific scientific paper, but I do know that the International Atomic Energy Agency publication, Radium in the Environment, addresses radium in in groundwater and discusses the isotopic ratios in that.</li> <li>BY MR. HUDDELL:</li> <li>Q. Okay. So let's move to sample ID LT-2. What what about these results shows that this would be natural and not not from the oilfield?</li> </ul>
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the normal ratio is. It's approximately 1:1 in normal soil, a little bit more Radium 228. But we also have the little bit higher Radium 228 than 226 in new produced water when it's first brought out of the ground. Subsequent to that though, is that we have the natural radioactive decay of both of those because they're taken away from their parent, the parents plural. Respectively, that's the the parent of Radium 226 is Uranium 238 and the parent of ultimately, the parent of Radium 228 is Thorium 232. So being taken away from their parents in in the formation from which the produced water came, they would be following their half lives and the Radium 228 concentration would continued to decrease faster than the Radium 226 concentration decreases.	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	<ul> <li>more factors that we have here.</li> <li>Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that that is a method of determining whether the radium that's being found in the groundwater is natural or from or from produced water?</li> <li>MR. VANTASSELL: <ul> <li>Object to form. Asked and answered.</li> </ul> </li> <li>A. I I don't know of any specific scientific paper, but I do know that the International Atomic Energy Agency publication, Radium in the Environment, addresses radium in in groundwater and discusses the isotopic ratios in that.</li> <li>BY MR. HUDDELL: <ul> <li>Q. Okay. So let's move to sample ID LT-2. What what about these results shows that this would be natural and not not from the oilfield?</li> <li>A. Well, the ratios of 226 and 228</li> </ul> </li> </ul>
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	A. Well, the initial ratios of Radium 226 and 228 in soil is is on several of the the references I listed here. The Meriwether documents we have what the normal ratio is. It's approximately 1:1 in normal soil, a little bit more Radium 228. But we also have the little bit higher Radium 228 than 226 in new produced water when it's first brought out of the ground. Subsequent to that though, is that we have the natural radioactive decay of both of those because they're taken away from their parent, the parents plural. Respectively, that's the the parent of Radium 226 is Uranium 238 and the parent of ultimately, the parent of Radium 228 is Thorium 232. So being taken away from their parents in in the formation from which the produced water came, they would be following their half lives and the Radium 228 concentration would continued to decrease faster than	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	<ul> <li>more factors that we have here.</li> <li>Q. Okay. And I was just wondering if there's a a published scientific study yet that that that recognizes that that is a method of determining whether the radium that's being found in the groundwater is natural or from or from produced water?</li> <li>MR. VANTASSELL: <ul> <li>Object to form. Asked and answered.</li> </ul> </li> <li>A. I I don't know of any specific scientific paper, but I do know that the International Atomic Energy Agency publication, Radium in the Environment, addresses radium in in groundwater and discusses the isotopic ratios in that.</li> <li>BY MR. HUDDELL:</li> <li>Q. Okay. So let's move to sample ID LT-2. What what about these results shows that this would be natural and not not from the oilfield?</li> </ul>



	29		30
1	approximately 1:1, if you include the	1	Q. Okay. All right. So I believe
2	uncertainties there. Again, the Eberline	2	you told me before that the the
3	data is consistent with that. The Pace	3	presence of the TDS will will draw the
4	Lab data is a a little bit out of line	4	naturally occurring radium in the soil
5	with that, but not too far. But still,	5	in the in the groundwater, will draw
6	both of those are consistent with that,	6	that into solution; is that is that
7	that the ratios are approximately 1:1,	7	right?
8	including the uncertainties, the	8	MR. VANTASSELL:
9	measurements. We also have a duplicate, I	9	Object to form.
10	believe there. The lab duplicate of LT-2,	10	A. Not at all.
11	and it's it also shows that.	11	BY MR. HUDDELL:
12	Q. Okay. Would you agree that at LT-	12	Q. Okay. Can you explain the affect
13	1, the the radium well, would you	13	that TDS has on the radium concentration
14	agree let me start over. The the	14	of the groundwater?
15	radium that's found at LT-1, is that	15	
16		16	A. Well, it you know, the more
17	greater than you would naturally find if the TDS had been lower?	17	solids you have in the water, whether or not it's related near an oilfield site
18 19	A. I'm not sure	18 19	or whatever, the more solids you have in
20	Q. Let me	20	the water, the more radium you'll have.
20	<ul><li>A I follow that question.</li><li>O. Yeah. Yeah.</li></ul>	20	The the radium is in the solids. So if
21		21	you just have more natural solids in the
23	A. Radium concentrations I'll just	22	water, then you'll have more radium in the
23	answer, the radium concentrations that are observed here, measured here, are	23	water. Q. Okay. If you have if if the
25	consistent with that amount of solids.	24	TDS is a result of, for example, high
20	consistent with that amount of solids.	2.5	TDS is a result of, for example, high
	31		32
1	chlorides in the groundwater from oilfield	1	that you have there. It typically is in -
2	operations, would would that would	2	- as as a chloride would be present
3	that result in in higher concentrations	3	there in the S with the S of TDS that
4	of radium in groundwater?	4	you have. But the more solids you have in
5	MR. VANTASSELL:	5	the water, the more radium you have. And
6	Object to form.	6	that's that's true.
7	A. Yes, that's the theory. Yes.	7	BY MR. HUDDELL:
8	BY MR. HUDDELL:	8	Q. And if the TDS got there from the
9	Q. Okay.	9	oilfield operations, wouldn't you say then
10	A. The higher the concentrations of	10	that the increased radium also got there
11	chlorides, it brings the natural radium in	11	from the oilfield operations?
12	the soil into the into solution.	12	MR. VANTASSELL:
13	Q. Okay. So so I thought you were	13	Object to form.
14	saying that the TDS itself is an	14	A. I don't know where the TDS came
15	indication of of of radium. Like	15	from, but if you have higher TDS present
16	the the TDS includes the radium	16	in a formation and if if that TDS
17	particles; is that right?	17	originated from produced water, yes, that
18	MR. VANTASSELL:	18	would be the case.
19	Object to form.	19	BY MR. HUDDELL:
20	A. It's hard to answer that question.	20	Q. Okay. Do you know one way or
21	The amount of radium by mass, by mass, is	21	another whether the 18,800 milligrams per
22	very, very small. A picocurie of Radium	22	liter of TDS, for example, at LT-1 came
23	226 is a picogram, approximately, a	23	from oilfield operations or not?
23 24	226 is a picogram, approximately, a trillionth of a gram. So the radium by	24	A. I don't know.
23	226 is a picogram, approximately, a		

Pages 29 to 32



		1	
	33		34
1	would you agree then that the increased	1	A. Not not just the other solids
2	radiation in the groundwater was a result	2	in there, but it's the chlorides that
3	of the oilfield operations that that	3	makes it more mobile.
4	contributed to the TDS?	4	Q. Okay.
5	MR. VANTASSELL:	5	A. And as you as you decrease the
6	Object to form.	6	chloride levels, the radium levels
7	A. No. I I can't say that one way	7	decrease.
8	or the other because the I I'm not	8	Q. And that's because the chlorides
9	an expert in the origin of the TDS we have	9	make the radium more mobile?
10	here. Now, there may be other analyses of	10	A. That's certainly the theory.
11	that water that would show that there's	11	That's what the International Atomic
12	other constituents in the water that would	12	Energy Agency report on radium in the
13	be related to oil production, but the	13	environment shows.
13	the radium levels here do not indicate	14	
14 15			
-	that we have this from oil production.	15	A. There's two different two
16	And that's all I did my opinions on, the	16	different reports. Let me look here.
17	radionuclides.	17	1990, that's on page page 16 of my
18	BY MR. HUDDELL:	18	report. It's Technical Report number 310.
19	Q. Okay. And and then there's a -	19	There are two volumes. And there's also
20	- a second mechanism I think you said that	20	2014 Technical Report. It was a revised
21	TDS makes the radium that's naturally in	21	edition. Technical Report Series 476.
22	the soil more mobile?	22	It's on page 16 of my expert report.
23	A. It it's the chlorides in the	23	Q. Okay. Did you look at the
24	TDS.	24	chloride levels at LT-1 to form your
25	Q. Okay.	25	opinion?
1		1	
	35		36
1	35 A. I don't recall specifically	1	36 Exhibit 3, which we've which we've
1 2		1 2	
	A. I don't recall specifically		Exhibit 3, which we've which we've
2	A. I don't recall specifically looking at those. Generally, as you get	2	Exhibit 3, which we've which we've which we've marked as Exhibit 3, your opinion number two says that, "Results of
2 3 4	A. I don't recall specifically looking at those. Generally, as you get higher TDS like you have here, the chloride levels are somewhere between 50	2 3 4	Exhibit 3, which we've which we've which we've marked as Exhibit 3, your opinion number two says that, "Results of laboratory analysis of groundwater samples
2 3	A. I don't recall specifically looking at those. Generally, as you get higher TDS like you have here, the	2 3	Exhibit 3, which we've which we've which we've marked as Exhibit 3, your opinion number two says that, "Results of laboratory analysis of groundwater samples from the subject property show the
2 3 4 5	A. I don't recall specifically looking at those. Generally, as you get higher TDS like you have here, the chloride levels are somewhere between 50 and 60 percent of the TDS, but I didn't	2 3 4 5	Exhibit 3, which we've which we've which we've marked as Exhibit 3, your opinion number two says that, "Results of laboratory analysis of groundwater samples from the subject property show the concentrations of radioactive materials in
2 3 4 5 6	A. I don't recall specifically looking at those. Generally, as you get higher TDS like you have here, the chloride levels are somewhere between 50 and 60 percent of the TDS, but I didn't look at it for it. MR. HUDDELL:	2 3 4 5 6	Exhibit 3, which we've which we've which we've marked as Exhibit 3, your opinion number two says that, "Results of laboratory analysis of groundwater samples from the subject property show the concentrations of radioactive materials in groundwater on the property are within the
2 3 4 5 6 7 8	<ul> <li>A. I don't recall specifically looking at those. Generally, as you get higher TDS like you have here, the chloride levels are somewhere between 50 and 60 percent of the TDS, but I didn't look at it for it.</li> <li>MR. HUDDELL: Okay. I'm going to mark as</li> </ul>	2 3 4 5 6 7 8	Exhibit 3, which we've which we've which we've marked as Exhibit 3, your opinion number two says that, "Results of laboratory analysis of groundwater samples from the subject property show the concentrations of radioactive materials in groundwater on the property are within the range of natural background radionuclide
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		37		38
	1	that led you to to the conclusion that	1	dispute that?
	2	those were that those were consistent	2	A. No. The transport of chlorides is
	3	with oilfield NORM?	3	not my area of expertise.
	4	A. The concentration of Radium 226	4	Q. Okay. How about the transport of
	5	compared with compared to the	5	radium in groundwater?
	6	concentration of Radium 228 in water in	6	A. Yes, to a degree. Yes, what the
	7		7	measurements would show. Yes.
		both of those samples, were greater than		
	8	one, even including the uncertainty of the	8	Q. Okay. All right. Do you know
	9	measurements. So the it indicated that	9	whether radium in the groundwater is more
	10	the it was all produced water,	10	or less mobile than than chlorides?
	11	indicated that because the Radium 228 had	11	A. I can't answer that. I don't
	12	undergone radioactive decay.	12	understand the question.
	13	Q. Are you aware that HET has written	13	Q. Yeah. Sorry. So the will
	14	a report in this case well, their case	14	will radium will radium move through
	15	that wherein they they say that	15	the groundwater at at the same rate as
	16	the chlorides that we're finding at at	16	as chlorides, do you know?
	17	Limited Admission Area 1 in the	17	MR. VANTASSELL:
	18	groundwater, are a result of the migration	18	Object to form.
	19	of constituents from the school board	19	A. I can't really answer that as
	20	property?	20	asked. Radium being a trace metal must be
	21	MR. VANTASSELL:	21	carried along with something, because
	22	Object to form.	22	radium is absorbed onto soil particles,
	23	A. Yes, I have read that.	23	especially clays very readily. And unless
	24	BY MR. HUDDELL:	24	you have an elevated chloride or something
	25	Q. Okay. Do you have any reason to	25	like something else, the formation,
	20	Q. Okay. Do you have any reason to	20	like something else, the formation,
		39		40
	1	especially the chloride, to keep it moving	1	MR. HUDDELL:
	2	along, at very high concentrations of	2	Can we take a five minute break?
	3	chlorides, then the radium will be will	3	THE WITNESS:
	4	not be moving at all.	4	Sure.
	5	BY MR. HUDDELL:	5	MR. HUDDELL:
	6	Q. Okay. Well, if if HET is right	6	Okay.
	7	and the chlorides have moved from the	7	VIDEOGRAPHER:
	8	school board property onto to the Levert	8	We are now off the record. The
	9	property, would you agree that it would	9	time is 9:48.
	10	have also transported some of the radium	10	(A brief recess followed.)
	11	as well?		
	12	MR. VANTASSELL:	11 12	VIDEOGRAPHER: Wo're now returning to the record
				We're now returning to the record.
	13	Object to form.	13	The time is 9:55.
	14	A. That's certainly the theory, but	14	BY MR. HUDDELL:
	15	the concentrations would have to be very	15	Q. Dr. Frazier, is it correct that
	16	high, and I don't know what how what	16	you didn't look at whether or not the
	17	the concentrations were necessarily to	17	radium would have migrated from the school
	18	cause that movement.	18	board property onto the Levert property?
	19	BY MR. HUDDELL:	19	MR. VANTASSELL:
	20	Q. Okay.	20	Object to form.
	21	A. There's radium there's radium	21	A. I looked at the concentrations of
	22	in all water and in all soil. So the	22	Radium 226 and 228 in the wells of the
	23	the presence of I saw no indication of	23	Levert property. I saw no data that
	24	a radium plume from that site.	24	indicated what was between those samples
	25	Q. Okay.	25	and the school board property, which would
			1	



	41		42
1	have indicated whether there was migration	1	A. Certainly, yes. The results were
2	from that. The data on the the	2	consistent with oilfield NORM in
3	groundwater concentrations on the Levert	3	groundwater.
4	property were consistent with naturally	4	Q. And the Radium 226 that is from
5	occurring radium in solids.	5	the oilfield operations on the school
6	BY MR. HUDDELL:	6	board property, when will when will
7	Q. All right. Does Radium 226 and	7	that when will that degrade to an an
8	228 migrate at the same rate? In other	8	undetectable level?
9	words, is there a difference in the	9	MR. VANTASSELL:
10	mobility of Radium 226 versus 228?	10	Object to form.
11	MR. VANTASSELL:	11	A. Well, you can always detect Radium
12	Object to form.	12	226 in groundwater, if you have sensitive
13	A. Not to not to my knowledge. It	13	enough instrumentation and analysis. But
14	depends on what matrix each of them is in,	14	the half-life of Radium 226 is 1,600
15	but they're the same element, so they	15	years. That's the half-life of Radium 226
16	would I don't know that there's any	16	in native Louisiana soils too.
17	difference in their migration, unless it's	17	BY MR. HUDDELL:
18	tied to the half-lives. But I don't	18	Q. Okay. So the Radium 226 that was
19	I've never seen anything that says they	19	from the oilfield operations found on the
20	are different migrations.	20	school board property will still be there
21	BY MR. HUDDELL:	21	in 1,600 years; is that right?
22	Q. Okay. On the school board	22	MR. VANTASSELL:
23	property, you did find at at least at	23	Object to form.
24	two sample locations, that there was	24	A. Depends upon whether the source is
25	oilfield NORM in the groundwater, correct?	25	removed. If the source is removed to the
	43		44
1	43 Radium 226, then it'll be gone.	1	44 a pit and some soil above ground soils
2		2	a pit and some soil above ground soils there too that was signed off on by the
2 3	Radium 226, then it'll be gone. BY MR. HUDDELL: Q. Okay.	2 3	a pit and some soil above ground soils
2 3 4	Radium 226, then it'll be gone. BY MR. HUDDELL: Q. Okay. A. Except except for the natural	2 3 4	a pit and some soil above ground soils there too that was signed off on by the or done performed by the Louisiana Department of Natural Resources.
2 3 4 5	<ul><li>Radium 226, then it'll be gone.</li><li>BY MR. HUDDELL:</li><li>Q. Okay.</li><li>A. Except except for the natural radium in native Louisiana soils.</li></ul>	2 3	a pit and some soil above ground soils there too that was signed off on by the or done performed by the Louisiana Department of Natural Resources. BY MR. HUDDELL:
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## JOHN FRAZIER 11/29/2022

	45		46
1	O Lundensten deltet Dutelse die	1	There is you your much
1	Q. I understand that. But the the	1 2	Thank you very much.
2	Radium 226 that was deposited there from	3	THE VIDEOGRAPHER:
3	the oilfield operations in the groundwater	4	This concludes this deposition. We're now off the record. The time is
4	on the school board property, 1,600 years		
5	from now, you'll still have half of much	5	10:01. The deposition concluded at 10:01 A M
6	as you as you do know, correct?	7	THE DEPOSITION CONCLUDED AT 10:01 A.M. ****
7	MR. VANTASSELL:	8	
8	Object to form. Asked and	9	
9	answered.	10	
10 11	A. I think I did answer that, but it	11	
12	certainly would be present in that location, but not necessarily in the	12	
13		13	
14	water, the groundwater in that location. It could well be absorbed it will be	14	
15		15	
16	absorbed as the chloride levels decrease,	16	
17	absorbed onto the soil particles. MR. HUDDELL:	17	
18		18	
19	All right. That's all the	19	
20	questions I have. THE WITNESS:	20	
20	Wow.	21	
22	MR. VANTASSELL:	22	
23	No questions for BP. Thank you	23	
23	for your time, Dr. Frazier, and Kevin.	24	
25	THE WITNESS:	25	
25	THE WITNESS.	20	
	47		48
1	REPORTER'S PAGE	1	CERTIFICATION
2	I, Lori B. Overland Certified Court	2	I, Lori B. Overland, Certified Court Reporter in
3	Reporter, in and for the State of	3	and for the State of Louisiana, as the officer before
4	Louisiana, the officer, as defined in Rule	4	whom this testimony was taken, do hereby certify that
5	28 of the Federal Rules of Civil Procedure	5	the above referenced individual to whom oath was
6	and/or Article 1434(b) of the Louisiana	6	administered, after having been duly sworn by me upon
7	code of Civil Procedure, before whom this	7	authority of R.S. 37:2554, did testify as hereinbefore
8	sworn testimony was taken, do hereby state	8	set forth in the foregoing pages, that this testimony
9	on the Record	9	was reported by me in the stenomask reporting method,
10	That due to the interaction in the	10	was prepared and transcribed by me or under my personal
11	spontaneous discourse of this proceeding,	11	direction and supervision, and is a true and correct
12	dashes () have been used to indicate	12	transcript to the best of my ability and understanding;
13	pauses, changes in thought, and/or talk	13	that the transcript has been prepared in compliance
14	overs; that same is the proper method for	14	with transcript format guidelines required by statute
15	a Court Reporters's transcription of	15	or by rules of the board, that I have acted in
16	proceeding, and that the dashes () do	16	compliance with the prohibition on contractual
17	not indicated that words or phrases have	17	relationships, as defined by Louisiana Code of Civil
18	been left out of this transcript;	18	Procedure Article 1434 and in rules and advisory
19		19	opinions of the board; that I am not related to counsel
	That any words and/or names which could		
20	That any words and/or names which could not be verified through reference material	20	or to the parties herein, nor am I otherwise interested
	-	20 21	or to the parties herein, nor am I otherwise interested in the outcome of this matter.
20	not be verified through reference material		-
20 21	not be verified through reference material have been denoted with the phrase	21	-
20 21 22	not be verified through reference material have been denoted with the phrase	21 22	in the outcome of this matter.
20 21 22 23	not be verified through reference material have been denoted with the phrase "(inaudible)."	21 22 23	in the outcome of this matter.



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