Statement of Don Nevin
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My name is Don Nevin. I am the President of Lamnipipe, Inc.

Lamnipipe was formed two years ago to study the possibility of making the High Volume Hydraulic Fracturing Process safer by reducing the presence of certain toxic components in Flowback and Produced Water.

In particular we have focused on radium in water although the technology can be applied to other undesirable trace or low volume materials.

Shortly after the inception of Lamnipipe we also developed LamniProppants. I shall briefly describe both.

Lamnipipe & LamniProppants consist of vertical pipe risers and conventional sand proppants which are coated with chemistry designed to sequester and immobilize specific molecules that are present in Flowback Water. In some cases this is accomplished using ion exchange resins, though our patents allow for a number of other chemical approaches.

Contaminants can be literally sorted along pipe lengths or in proppant beds. For example it may be desirable to remove barium compounds from the Flowback stream prior to removing radium. Layered bedding of proppants and sequestering banding of pipes allows this separation within the fracturing cycle.

The goal is to keep radium from ever reaching the surface where it makes processing and disposal of wastewater more complex. It also avoids radioactive scale, spills, transport of radioactive water and the numerous other things that can go wrong but which cannot always be anticipated.

While there presently is no reason to think that Flowback Waters are radio-contaminating drinking water per se there is reason to feel that if we could make the radio component of these Flowback Waters disappear at low cost we could be mitigating many potential problems.

So the question becomes: If we could remove radium from waste water before it comes to the surface should we do it? The answer would appear to be yes provided the cost is not prohibitive.

Sub-Surface Removal of Radionuclides from Flowback Water in High Volume Hydraulic Fracturing

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The Radionuclide HVHF Problem and a Possible Solution

High Volume Hydraulic Fracturing (HVHF) for Natural Gas Production presents many challenges for Drillers, Landowners, Lease Holders, Regulators, as well as those who are Environmentally Concerned.

Natural Gas, while an important Primary or Transitional Energy Source is not without problems and controversy.

Backflow and Production Waters are contaminated with industrial chemicals as well as brines and other compounds liberated from shale during the process. The latter often includes a certain amount of radionuclides (particularly Radium) which has decayed from Uranium over millions of years.

Various studies have show these radiation levels to be highly elevated (often 1,000 pCi/L) from the levels that would be acceptable under normal circumstances (5 pCi/L). The levels are also somewhat unpredictable. While Radium is almost always present, episodic Uranium may be present in isolated pockets while, in other cases, It may be completely absent.

Other radioactive contaminants have included Thorium, Polonium, Radon gas, and some rarer daughter products.

Once these radioactive contaminants reach the surface they create issues that would not exist if it had been possible to keep them deep underground.

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Sequestration and Lamnipipe and LamniProppants

Lamnipipe proposes a simple, yet elegant, method for keeping most radionuclides out of Flowback Water and Production Water.

The core concepts of the technology have been in use for and proven over many years. The basic chemistry is commonly used in Municipal Water Facilities.

The patents which we have filed mate this proven chemistry with the mechanical constructs of the HVHF Process; notably the pipe (or drill string), casings, and the proppants.

It should be realized that this technology is also useful for extracting certain non-radioactive components from the water if there is a reason to do so. For example if it was determined that arsenic or a specific organic be sequestered that can be done also. The patents are not tied to radionuclide extraction alone.

The technology is not useful for extraction of the large amounts of salts and brine as these would quickly overwhelm the capacities of the pipe and would cause the fractures to 'seize' and nothing would be accomplished.

The goal is to have non-radioactive brine reach the surface where it can be transported more safely to injection wells or filtration plants.

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What are Lamnipipe and LamniProppants?

Lamnipipe and LamniProppants are pipe and proppants which are surface treated with selected sequestering agents that will trap and physically stabilize radionuclides (or other specific contaminants) underground.

In the case of Lamnipipe the coatings are applied after the pipe is in place but before Hydraulic fracturing takes place. The coatings are customized to the local situation. They can extract contaminants at a specified depth either all together or in 'bands' –different contaminants at different depths. The mechanism for applying the compounds is an electro-mechanical 'pig' which is sent down the pipe to the appropriate depths, coats the pipe or casing as required, and is then withdrawn.

If a well is re-fracked the coatings can be reapplied with the 'pig'.

In some cases (shallow wells) laminar flow disruptors may also be used to assure that the contaminants come in contact with the greatest inner pipe surface area possible so that no water 'escapes' the process.

LamniProppants are conventional proppants (proppants are generally sand particles that are forced into fractures to keep them open) coated with the sequestering materials. As these proppants become entrained in the fractures the contaminated radioactive water flows over the surface and the contaminant becomes bonded in sutu.

In many, but not all, cases Dow products (such as Dowex Ion Exchange Resins) are used.

The particular materials used by Lamnipipe for Radium and Uranium sequestration are approved for drinking water contact and have a decades long history of use in municipal water facilities.

The changes in technology relate to the method of application, particle size, uploading potential, and other unique aspects.

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A Well Computation

Obviously wells come in different shapes and sizes. Most will release Radium into the Flowback Water when shale, under tremendous hydraulic pressure, exceeds its elastic limit. Some water will contain substantial amounts of episodic Uranium. Daughter products such as Thorium and Polonium may be present and Radon (a radioactive gas) is always present.

For purposes of simplicity we use the conversion 1 Curie = radiation produced by 1 gram of Radium. While this is no longer the most accurate approach it is close enough for our computation.

Assumptions: Well uses about 5 million gallons of water or approximately 2 x 10^7 litres (L). While only a portion of that water flows back we use the entire amount to compute Radium loading in situ to provide a safety factor of about 50%.

Flowback water radiation 1000 pico-curies/litre or 10^3 pCi/L - therefore;

Well total radiation is 2 x 10^10 pCi or 2 x 10^7 nCi.

Ion Exchange Resin Loading (per studies in high Radium environments may run as high as 2-- - 300 nCi/gm); we will use 100 nCi/gm (that is per gram of active IER media bonded to proppant and/or pipe).

This works out to about 220 lbs of IER media (10^5 gm) for the entire well.

It should be noted that these figures are based on a mesh size (particle size) of 16. We will likely mill down to a mesh size of 100. That has the effect of increasing surface area and availability by a factor of about 20. We have NOT considered the enhanced surface area in our calculations. The milling will increase the efficiency although not by a factor of 20.

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We use a real world multiplier of 4.5 so perhaps 1,000 lbs of IER media would be necessary for the above described well.

This would have the capability to reduce the 10^3 pCi/L to 5 pCi/L or less.

The cost is quite modest, and insignificant in relation to the well construction cost, although the exact details are presently confidential.

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Irradiated Metal Entering the Stream of Commerce

Recently a large retail chain, Bed Bath and Beyond, was forced to recall some metal tissue boxes due to radioactive contamination of the metal. The metal was contaminated with radioactive cesium. The boxes had been sourced in India and it is likely that the metal had previously been used in a nuclear power plant or in a medical device or weapons facility that used radiated materials. It is likely that the exact source will never be known but it does indicate that radioactive metals have started entering the stream of commerce.

That is a sobering thought because such incidences are unlikely to manifest themselves though it is clear they can do a great deal of harm.

One of the issues with drilling pipe is that the above ground superstructure (pipes, tanks, derricks, and so forth) do become radioactively contaminated. For this reason oil field workers wear radiation exposure badges.

It is entirely possible that some of the metal superstructures will, at some point be scrapped and the metals utilized for other products. The result is that Radium or other radionuclides from deep below the ground can work itself into various products including piping used in playgrounds.

For this reason the idea of keeping the radionuclides deep within the earth is important as it reduces the possibility that unaware consumers will come in contact with well originated radionuclides.

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Remediation, Presumptive Remediation and Best Practices

While Lamnipipe and LamniProppants are new technologies the underlying chemistry has been used for many years to achieve like results

As HVHF is being used continuously it is our hope that EPA and the courts will consider this technology as a Presumptive Remedy for the mitigation of radioactivity in water and that it will consider it as an important element of Best Practices and Best Available Technology (BAT).

Since the chemistry works its use could be started immediately while comparative studies are developed over time. Common sense would seem to dictate that anything which has the prospect of reducing radiation brought to the surface and which is not unduly burdensome and costly should be quickly implemented.

It should be remembered that the chemistry is APPROVED SAFE for DRINKING WATER CONTACT.

Some Recent Events Related to Lamnipipe and LamniProppants

In the last six months (since January 2012) a number of important events have occurred which may further illustrate the advantages of this technology.

1. In January the EPA contacted NYS DEC in regard to the issue of radiation in Flowback Water and suggested that the proposed NYS regulations (the SGEIS) did not adequately address that problem.
2. An ongoing EPA six well study being done around the country has found Radium in the Flowback Water of every Natural Gas well studied. This further shows the merit of keeping that radiation deep in the ground.
3. Lamnipipe, Inc. has filed another patent that expands upon the original technology and should make us a leader in this field.
4. Substantial additional third party testing has been made available which, while not commissioned by us, supports our technology.
5. OSHA has initiated a program which may result in radiation placarding on the superstructures (above ground portions such as tanks, pipes, derricks) which might have contained radioactive water or scale.
6. We have determined that Lamnipipe and LamniProppants will be useful in drilling into "Tight Oil Formations" as well as for Natural Gas.
7. Lamnipipe appears to be possibly useful in certain aspects of GasFrac technology as well as in tandem with other technologies.
8. DOT is looking into the issue of trucking waste water which, while radioactive, is not placarded as such.
9. We have introduced a new product – LamniSleeves – for use in shallow well and above ground situations.
10. Our pending patent is highlighted in a recent issue of "Lexology".
11. There has been some additional activity on the litigation front which, I think, makes the use of our product potentially important defense against the inevitable long-tail liabilities which

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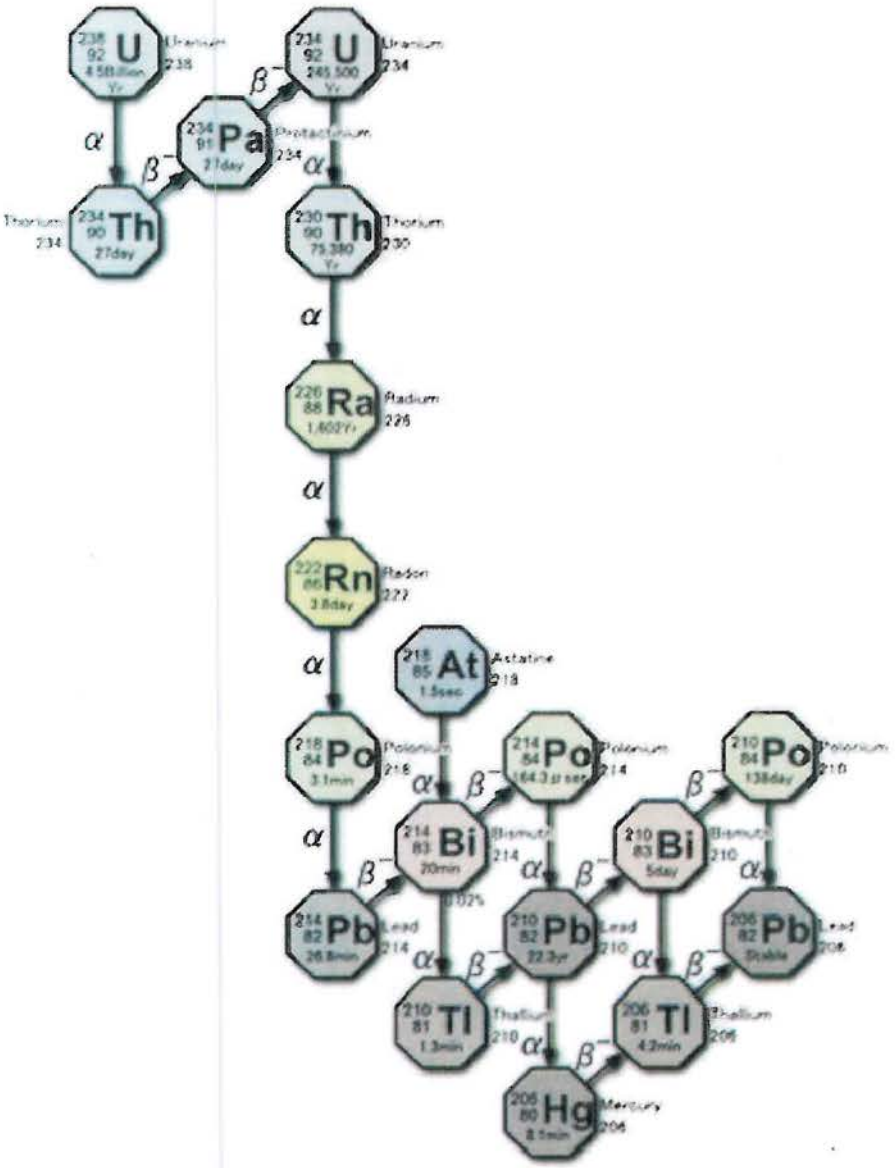
will arise and may even be regarded as a form of presumptive remediation.

Uranium Decay Series-

Half-life: ^{238}U 4.5×10^{9} Y

^{226}Ra 1600 Y

^{222}Rn 4 Days



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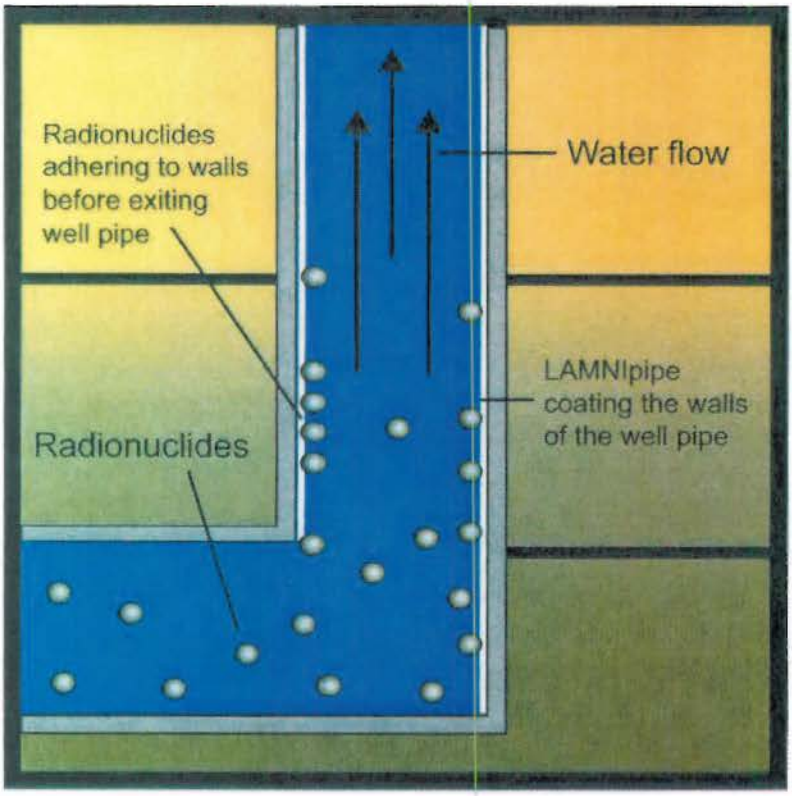
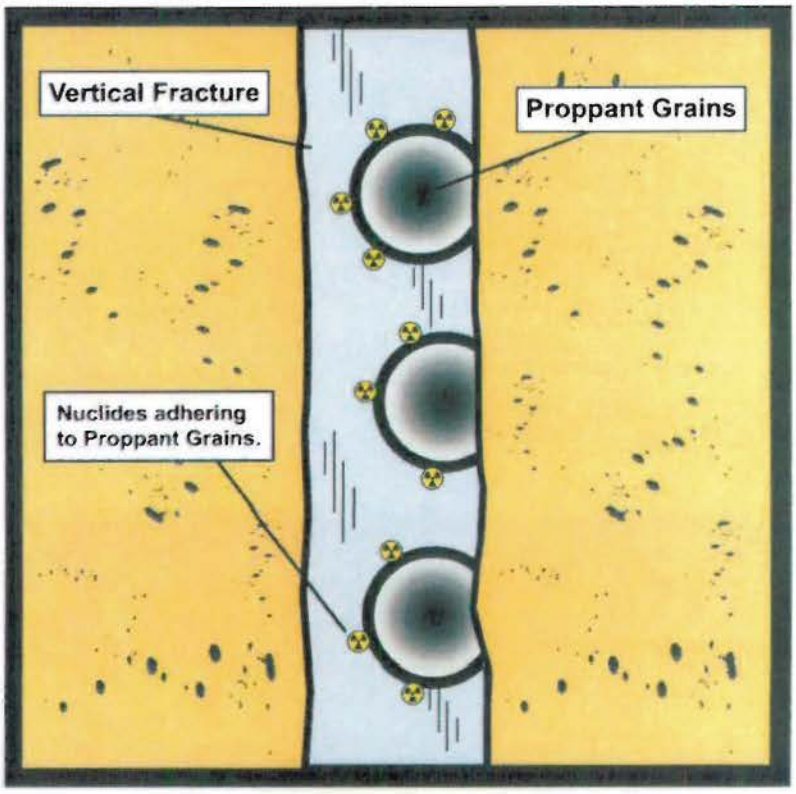
LamniPipe:



Lamni-Proppants:



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Keep it Down There

MAKING HYDROFRACKING SAFER-

Hydrofracking – The key to obtaining substantial yields of natural gas from wells drilled into hard shale rock has been used for many years throughout the US, Canada and many other countries.

In recent years, as the technology has evolved, it has also become controversial in some areas.

While **EPA** and regional governmental bodies are trying to optimize the risks versus returns and with consideration to US Energy Security new technologies are starting to emerge to deal with some of the potential problems.

One issue which is starting to be addressed is the presence of Radium and other Radionuclides (including Radon) in Fracking Flowback Water and Produced Water.

When rock is fractured deep beneath the ground there is often a certain amount of Radium present.

Radium is a decay product of Uranium which was present in the rock hundreds of millions of years ago. Radon is a decay product of Radium.

Lamnipipe is designed to prevent Radium and Radionuclides from travelling to the surface when Frack Water and Produced Water is withdrawn.

SCIENTIFIC AMERICAN ARTICLE on radiation in Flowback Water

I-TEAM REPORT on Radiation in water wells

SCIENCE DAILY on Uranium in Flowback Water

MARCELLUS SHALE REPORT Pages 17-19 discuss Marcellus Shale Radiation in Flowback Water.

RADIOACTIVITY IN MARCELLUS SHALE REPORT on Radiation in Flowback Water

IAEA REPORT on Radiation Protection and the management of of Radioactive Waste in the Oil and Gas Industry.

NEW YORK TIMES ARTICLE on Regulation of Radioactive Well Water from Natural Gas Drilling

LAMNIpipe- Keep It Down There!

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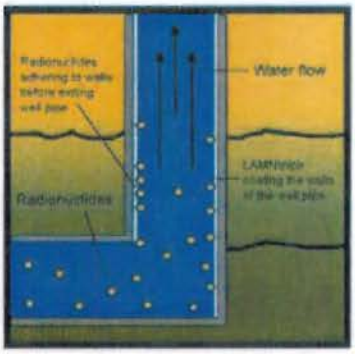
Keep it Down There

THE TECHNOLOGY-

So How Does Lamnipipe Work and Why Should It Interest You?

Simply put, **Lamnipipe** technology sequesters radioactive particles to the inside of the well pipe during ***Hydrofracking.*** This means the water that is extracted from the well only needs to be processed to remove suspended solids and other chemicals but the radioactive component of Flowback Water and Produced Water will be greatly reduced – even below background levels.



The **Lamnipipe** Liners and Coatings can be customized to the Fracking job at hand. For example if a well is 8,000 feet deep, technicians may decide that they want the radiation to be captured within the first 2,000 feet of pipe rise. In a shallower well they might specify 500 feet. The point is that by keeping radionuclides below the surface, the safety of waste Frack water is enhanced.

The **Lamnipipe** technologies are patent pending in the United States and other countries.

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LAMNI-PROPPANTS:

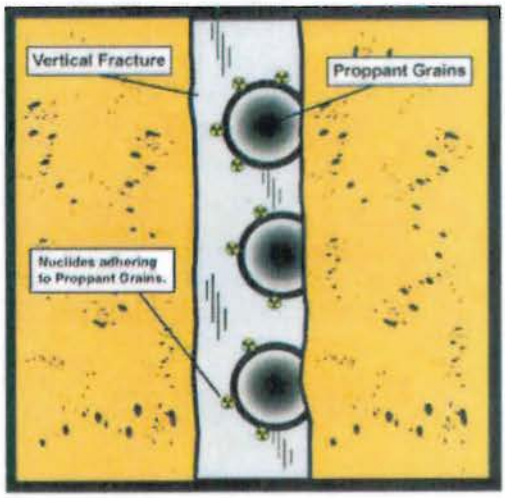
Contamination Sequestering Proppants-

Lamnipipe is happy to announce new ***Lamni-Proppants***. These are in situ proppants coated with contaminant sequestering chemistry. As they keep the fractures open, they also sequester and stabilize radionuclides, arsenic compounds and other toxic targets within the fractured shale matrix.

Lamni-Proppants are particularly useful in sequestering radionuclides from Produced Water, which contain high concentrations of radionuclides.

Lamni-Proppants can be customized to the geologic and regulatory environment unique to each well. ***Lamni-Proppants*** work for both Flowback Water and Produced Water.

Please check out this link- which features the NY Times Editorial, "The Debate on Fracturing", and then view our letter to the editor.



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HOMELAND SECURITY & BLACK SWAN EVENTS-

Radioactive contamination of water and chemical attacks will always be threats to national security.

An important feature of **Lamnipipe** is that it keeps frack generated radionuclides safely below ground- thousands of feet below the surface.

Various aspects of the drilling process can cause radionuclides to concentrate either by natural processes, the geometry and geology, or hydrology of a site. Unexpected or unanticipated concentrations of such materials as Thorium, Strontium, Radium, and Uranium are undesirable from a national security standpoint. Also, once radionuclides are brought to the surface there are multiple ways in which they can be extracted and concentrated from contaminated water. Obviously this presents a potential hazard.

Lamnipipe solves this concern as it bonds the radionuclides to the interior pipe- so deeply that there can be no possibility of them being extracted even from an abandoned, capped well. In addition, automated paint-over procedures can ensure that there is no way to ever bring these hazardous substances to the surface.

Black Swan Events-

An Excellent discussion of **Black Swan Events** is the one in the June 2011 *Scientific American* (p. 50):

"...black swan events- highly unlikely occurrences that have big repercussions. A rare event - especially one that has never occurred - is difficult to foresee, expensive to plan for and easy to discount with statistics. Just because something is only supposed to happen every 10,000 years does not mean it will not happen tomorrow."

A few recent examples are the earthquake and tsunami in Japan that led to the Fukushima plant meltdown, Hurricane Katrina, the Flash Crash of May 6, 2010 (which appears to have done no lasting damage).

In the case of radionuclides being brought to the surface or entering aquifers despite careful planning, such things as ground slump or minor earthquakes could shear pipe and casing. Only a few hundred tons of earth and rock in motion can shear a drill string. Accidental pressurized water intrusion from underground water chambers would be unpredictable until after such an event. These type of incidents could result in radioactively spiked water migrating up the drill pipe.

A helpful technology would be **Lamnipipe** coating which would reduce the radiological impact of such unlikely events at a low upfront cost.

If such coatings had been on the outflow pipes at Fukushima, the amount of radiation dumped into the Pacific Ocean would have been much less. So planning for the unforeseeable has merit *because things that cannot happen sometimes do.*

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LONG-TAIL LIABILITIES-

Long-Tail Radiation Liability in Hydraulic Fracturing:

Historically, certain new technologies have entailed certain risks which were unidentified at their inception. The list is long but includes asbestos use for insulation, lead as an anti-knock compound in gasoline and as a component of paints, MTBE, PVC and many others.

In general had these risks been known or acted upon palliative or prophylactic actions could have been taken on earlier to reduce both human suffering and scorched earth legal battles familiar to us all.

In addition, there is now acknowledgement that unanticipated events -so called Black Swans- do occur with some frequency despite the lack of predictability. Examples include the Fukushima Nuclear disaster and the recent floods in the Binghamton (NY) area in which the Marcellus shale is present.

The Long-Tail risk addressed by ***LamniPipe*** and ***Lamni-Proppants*** is that of radiation which exists within the shale matrix and will, despite all efforts, reach the surface in varying amounts.

Once at the surface it may increase worker exposure, leak from containment vessels or pipes, leak from waste trucks onto highways, pollute streams or aquifers on a continuous or intermittent basis and just play havoc with the safety issues that concern everyone in the industry.

When coupled with the occasional Black Swan Event such as the Fukushima tsunami or the Binghamton Floods of 2011, one can appreciate that these are non-quantifiable but existing risks. The smart approach is to deal with them now, rather then later.

By using relatively inexpensive measures to keep radionuclides buried at known depths within the shale or lower pipe string, the likelihood of the negative consequences cited above can be minimized to the benefit of the industry and the consumer.

While it may take some time for Radiation Sequestering Technology to be mandated in all cases, those engaged in drilling, insuring and financing Hydraulic Fracturing projects should consider the likelihood that LamniPipe and Lamni-Proppants will be considered a Presumptive Remedy.