History of Oil and Gas Well Abandonment in New York

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Summary:

The aim of this study was to evaluate the success of New York State's regulatory program for the oil and gas industry with respect to post-production plugging and reclamation. Annual reports from the Division of Mineral Resources, New York State Department of Environmental Conservation over the last twenty-five years portray an oil and gas industry which has consistently neglected to plug most (89%) of its depleted wells. In this regard, the most recent record has been the worst: Plugging percentage rates ranged from 3.5 to 7.1% throughout the 2000's. Further, there is no program, existing or proposed, to periodically monitor and repair plugged and abandoned wells which have begun to leak. Therefore, new plugging and reclamation guidelines presented in the revised draft Supplement to the Generic Environmental Impact Statement for the Oil, Gas and Solution Mining Regulatory Program (*rdSGEIS Section 5.17*) , and proposed new regulations for plugging and abandoning depleted oil and gas wells (*6 NYCRR Section 555.5*) are inadequate. Moreover, they are mere academic exercises: Unless the State of New York State does something to dramatically alter the long-standing culture of neglect, we can reasonably expect oil and gas industry operators to ignore any new standards just as they systematically ignore existing standards today.

Introduction:

New York's oil and gas industry is just nine years from its bicentennial, since the pilot project, a natural gas well near Fredonia, was drilled in 1821. As our first oil and gas wells went into decline, a new issue was recognized, and New York became the first state to require the plugging of abandoned wells in 1879 (1, 2). No particular state entity existed to monitor compliance or enforce the plugging law, but an 1882 amendment to it offered half of any collected fines to informants who reported violations (1). One hundred thirty years later, we have a dedicated and sophisticated Bureau of Oil and Gas Regulation (BOGR) within the Division of Mineral Resources (DMN) of our Department of Environmental Conservation (DEC). State guidance documents and regulations have undergone multiple updates, including those newly proposed in the revised draft Supplement to the Generic Environmental Impact Statement for the Oil, Gas and Solution Mining Regulatory Program (rdSGEIS), and 6 NYCRR Parts 52, 190, 550 – 556 and 560 (new regulations).

With great attention paid these days (and justly so) to questions of proper gas well construction, appropriate control of chemicals and wastes, and other production issues,

post-production cleanup has received relatively little notice. In numerous discussions with both opponents and proponents of shale gas development, all appear to consider our state's legacy of improperly abandoned oil and gas wells a "real" problem, but an "old" problem; the common perception is that the DEC now has this issue under control.

However, the issue is both nuanced and pressing, according to Lou Allstadt, a former senior oil and gas company executive (3): "Very little attention is paid to the end of the life of an oil or gas well. I think you will find that it is rare for the larger companies to plug and abandon their older wells. Rather, at some point, a smaller company with lower overheads and less expensive operating costs will offer to buy the old wells at a price that gives the original company a better return than continued operations. The original company uses the cash to finance new investments. The buying company operates with lower costs because they spend less on maintenance and safety items and they have fewer well qualified people to pay. The chain may end there or continue through smaller and ever lower cost operators who do no preventive maintenance at all, do the bare minimum of repairs to keep the well going and eventually walk away, maybe after plugging the hole as cheaply as possible and maybe not plugging at all. The smaller companies often operate each well or group of wells under a separate corporate entity that is always stripped of cash, so if something goes wrong there are no assets to pay off claims. Not all small operators will do this, but it happens.

"In conventional fields these selling/buying cycles might start when the field is 20 - 30 years old and run for another 20 -30 years. By the time these wells are abandoned, the casings have been subjected to corrosive fluids for many years. At the end there is just enough left to squeak past any inspections. When it costs too much to repair versus what might be produced, the well is abandoned. Whether it is plugged before it is abandoned depends on the final operator. In tight shale this could all take place over a much shorter time period and the abandoned wells could increase quickly." (3) Indeed, industry analysts have presented evidence that tight shale gas wells decline much more quickly than oil and gas wells in conventional deposits. (4)

A second area of concern is that well casings deteriorate over time, and begin to leak (5 – 7). Due to a combination of cement cracks and continued development of pressure from gases and other fluids (5), leaks have been shown to develop in half of the well casings studied in just fifteen years (6). Leaks in plugged wells have also been demonstrated (7). The idea that plugged wells are indefinitely stable is obviated by these industry reports, so to be effective, our oil and gas regulatory program must not only ensure that abandoned wells are properly plugged, but must also periodically inspect – and, if necessary, repair – the plugged and abandoned wells.

The central question of this study is, "How successful has our oil and gas regulatory program been, particularly with respect to post-production plugging, reclamation and inspection?" Credible answers to this question have been, as this author discovered, "hiding in plain sight" for years.

Methods:

Data Sources:

Most data for this investigation came from annual reports by the DEC's Division of Mineral Resources (DMN). Reports which were accessible from the DEC's web site included those from 1994 through 2009 (8). Reports from 1985 through 1993 were obtained by request from the DEC. Other data came from the 1994 New York State Review (STRONGER) report (9) and the New York State priority plugging list (10). These reports constitute the entire official body of public records on this topic in the State of New York.

Influence of Shut-in Wells:

The results are expressed in terms of oil and gas wells which had been reported as "inactive", defined as having zero production. To evaluate them appropriately, the reader should note that an oil or gas well may be considered inactive either because it is depleted or shut in. A shut-in well is one which is capable of producing oil or gas, but is not connected to a pipeline or for some other reason is temporarily sealed to prevent product loss. It is unlawful to shut in an oil or gas well in New York State for more than one year, except by specific permission from the DEC (§*6 NYCRR Part 555.2*). The data for this study were collected from the "abandoned wells" sections of the annual reports, where such sections existed (reports from 2002 and later), and the context of the narratives consistently implied that the inactive wells cited there were, in fact, depleted. However, data from earlier reports were taken from oil and gas production tables which provided no narrative context. Therefore, it should be noted that any shut-in wells inadvertently included the "inactive" column would yield plugged oil and gas well percentages which were slightly lower than their true values.

Influence of "Other" Plugged Wells:

The annual reports data for plugged wells included oil, gas and other regulated wells. The "other regulated wells" included salt solution and stratigraphic geothermal wells, and their numbers were expressly stated in only seven of the reports (from 2003 – 2009). The numbers of these "other" wells ranged from 15 to 55 per year. To maintain consistency of data handling across the entire 25 years reported, these "other" wells were not subtracted from the "plugged" column. Therefore, it should be noted that this yielded percentages for plugged oil and gas wells which were higher than their true values. These are noted below as "uncorrected values".

Results:

The results of this study are summarized in Table I:

Table I: Annual Plugging Rates of Abandoned Oil and Gas Wells in New York State

Year	Inactive*	Plugged	Percemt†	Comments
1985	2505	269	10.7	
1986	2468	471	19.1	
1987	2543	417	16.4	
1988	2348	322	13.7	
1989	2620	260	9.9	
1990	2707	**961**	35.5	Record high number of wells plugged
1991	2069	376	18.2	
1992	1502	244	16.2	
1993	1642	263	16.0	
1994	1887	248	13.1	48,000 total abandoned O & G wells estim. (9)
1995	1784	219	12.3	
1996	2215	233	10.5	96 newly discovered abandoned
1997	1974	187	9.5	200 newly discovered abandoned
1998	2169	169	7.8	
1999	1748	138	7.9	270 newly discovered abandoned
2000	2190	131	6.0	220 newly discovered abandoned
2001	2259	**79**	3.5	150 newly discovered abandoned
2002	2272	146	6.5	first mention of priority plugging list
2003	2379	142	6.0$^{\Delta}$	
2004	2526	145	6.0$^{\Delta}$	
2005	2658	150	5.6$^{\Delta}$	2117 known wells unreported
2006	2871	213	7.4$^{\Delta}$	1103 known wells unreported
2007	2460	192	7.8$^{\Delta}$	822 known wells unreported
2008	3071	221	7.2$^{\Delta}$	57,000 total abandoned O & G wells est. (10)
2009	3043	240	7.9$^{\Delta}$	
2010				not yet released to public
2011				priority plugging list details 4722 wells (11)

* Oil and gas wells reported to have zero production
† Plugged divided by inactive wells x 100
$^{\Delta}$ Uncorrected values

As indicated in the table (above), oil and gas industry operators have consistently failed to plug and properly abandon most inactive oil and gas wells as long as records have been kept by New York State. Over the 25 years available for study, just one out of every nine depleted wells was plugged properly, (mean average = 11.2%). And the more recent segment of the record is worse than the earlier part: throughout the 2000's, plugging rates ranged from 3.5% to 7.9% (uncorrected values), with a mean average of 6.4% for that 10-year period. By comparison, plugging rates for the preceding 15 years ranged from 7.8% to 35.5%, with a mean average of 14.5%. Obviously, none of these plugging and reclamation rates approached 100%.

However, the percentages shown in Table I for the years 2003 to 2009 are known to be inflated, since the numbers of "other than oil and gas" wells which had been plugged were reported. Corrected plugging percentages for those years are presented in Table II:

Table II: Corrected Plugging Percentage Values, 2003 – 2009

Year	Inactive	Plugged	"Other"	Corrected*	Percent†
2003	2379	142	15	127	5.3
2004	2526	145	39	106	4.2
2005	2658	150	55	95	3.6
2006	2871	213	22	191	6.7
2007	2460	192	31	161	6.5
2008	3071	221	12	209	6.8
2009	3043	240	24	216	7.1

* Plugged minus "other" wells
† Corrected divided by inactive wells x 100

When the values from Table II are folded into the overall data set – an awkward operation, since not all of the percentage values can be corrected with the information available, the average oil and gas well plugging rate falls to 10.9% over 25 years, the average rate from 1985 to 1999 remains unchanged at 14.5%, and the average percentage of inactive oil and gas wells plugged from 2000 to 2009 falls to 5.6%, with a range of 3.5 to 7.1%. Again, none of these post-production cleanup rates approach 100%.

Now, the true scale of our problem with orphan abandoned oil and gas wells in New York State is not known. The reports consulted did not distinguish between newly depleted wells and inactive wells which were carried over from previous years. Thus, the "snapshot" found in each annual report does not provide a basis from which one can construct a running tally of these wells. The estimated totals included in the table above – one, 48,000, from the DEC's response in 1994 to an external review panel (9) and the other, 57,000, from the 2008 annual report (originally found in (10), but absent from with the subsequently revised online version) – were not accompanied by any form of accounting; they were, in this author's opinion, arbitrary and unsupported.

Approved well transfers could conceivably provide a means of access to abandoned oil and gas well totals. Some 13,000 such transfers were made from 1987 – 1994, and more than 1600 annually since then (annual report series from 1994 to 2009). However, as pointed out above (3), there is no "formula" that relates changing well ownership to numbers of depleted wells, so this approach would not lead to a reliable estimate for wells abandoned during the years reported, let alone in the decades that preceded any agency records (1821 – 1966) (1, 2).

An assumption that the wells on New York's priority plugging list (11) constitute all the orphan abandoned oil and gas wells in the state would also be unsound. Details within some of the reports directly contradict such a notion. For example, the inactive wells reported in 2005 plus the known, unreported wells and "other, known orphan wells" (12) sum to nearly 9000 wells, nearly twice the 4722 wells on the current priority plugging list (11), and twenty times the number of wells on that list in 2005. Further, quoting from the 2009 annual report, "Most of the [abandoned] wells date from before New York established a regulatory program." (13); reports from 2002 onward suggest that the locations of fully half of our orphan abandoned oil and gas wells are not known. Clearly, the wells in undisclosed locations are not on the priority plugging list. We may never know exactly how many abandoned oil and gas wells are in New York, but the more than 4700 on the priority plugging list appear to represent just the proverbial "tip of the iceberg".

What significance does this issue have for anyone? As if to answer this question, the authors of the 2002 and 2003 annual reports (Mineral Resources Division Director Bradley J. Field and his staff) (14, 15) presented case studies of individual abandoned oil and gas wells. Selected cases are re-presented below for illustration.

Figure 1: "This Priority Plugging List well in the City of Rome, Oneida County was discharging brine at a rate of five gallons per minute into a wetland adjacent to Brandy Brook and had already killed over an acre of vegetation in 1998." (14)

Figure 2: "Pipeline company employees detected natural gas emanating from two residential lawns in the Village of Rushville, Ontario and Yates County. Explosive gas levels were also found inside a garage. Division staff uncovered two natural gas wells in the vicinity. Gas in the soil declined when the wells were vented under DEC direction. Roughly 24 gas wells were drilled in the village in the 1900's and need to be plugged when funds are available. The backhoe is excavating a leaking well next to a building." (14)

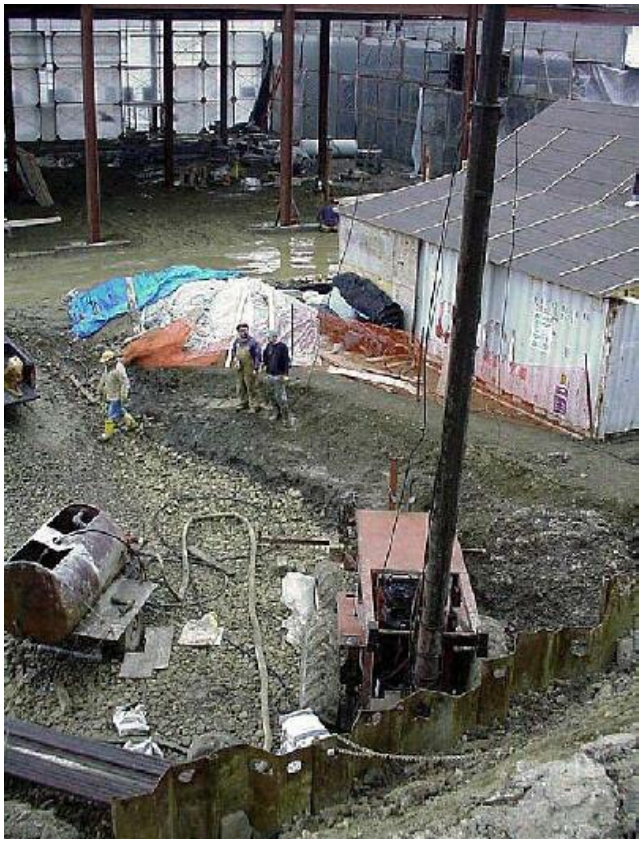

Figure 3: "During construction of a new bus garage at the Bolivar-Richburg High School in Allegany County, several buried abandoned wells were uncovered. Since no well records were available, the school had to bring in a small service rig (red equipment in foreground) to check the condition of the wells. All the wells had to be plugged before construction could resume. This is not the first school well incident that the Division has handled. For example, in nearby Wyoming County DEC plugged a gas well that was leaking brine in the parking lot of Wyoming County Central School in 1991." (14)

Figure 4: "Town of West Union, Steuben County ... abandoned well near creek leaking crude oil to water" (15)

Figure 5: "Old abandoned oil well under water in Town of Bolivar, Allegany County" (15)

Figure 6: "A landowner in Cattaraugus County complained that a small oil leak in their yard was keeping away potential buyers for their house. An old map shows the well to be part of a long abandoned lease, but the Department does not know who the responsible party is. (15)

Figure 7: "In 2003 a landowner in Allegany County reported that a leaking well was causing an oil scum on their pond. The party responsible for the wells is an inactive company that has been the subject of pending DEC legal action for over 12 years. This is just one of the company's hundreds of long-abandoned wells." (15)

Conclusions and Recommendations:

From the evidence presented, it is clear that New York State's problems with abandoned oil and gas wells have never been brought under control and are growing worse with time. Notwithstanding efforts by the DEC's Bureau of Oil and Gas Regulation, industry operators routinely neglect post-production plugging and reclamation, and the ill effects are visibly widespread across the state. This finding directly contradicts statements from pro-industry spokespeople (such as representatives of the New York Independent Oil and Gas Association (NYIOGA) and others) to the effect that, "This industry is safe." This industry is not "safe" now, has never been demonstrated to be "safe", and will not become "safe" so long as oil and gas operators refuse to plug their wells and restore their work areas. Compliance with existing laws and regulations will arguably require a change of culture within the industry, an objective which has eluded regulators from their earliest attempts. From this perspective, New York State's oil and gas regulatory program has failed.

Under current regulatory conditions, the advent of high-volume, hydraulically-fractured (HVHF) shale gas development to New York can reasonably be expected to result in an escalation of environmental and public health impacts, due to the increased scale of shale gas projects and compressed time frames for project development and decline. Therefore, this author's first recommendation is to prohibit all HVHF projects until:

(a) All oil and gas wells in New York State which are known or suspected to require plugging have been added to the priority plugging list, and

(b) Every well on that list has been plugged and the area reclaimed.

The objective would be to demonstrate oil and gas industry compliance with existing laws before approving any more intensive industry operations in the state.

Secondary to that measure, BOGR officials should immediately be directed to prevent financially unqualified owners from obtaining oil or gas wells through transfer requests. If there isn't enough money available to locate and plug the state's abandoned wells, then our bonding and security levels are set too low. Regulation *6 NYCRR Part 551* should be further revised – using comprehensive cost-based analysis – to provide for bonding and financial security levels sufficient to plug and reclaim all oil and gas projects, with no discount for multiple wells.

The proposed § *6 NYCRR Part 555.5* should be further revised to include an evidence-based set of minimum plugging standards, instead of the arbitrary standards currently proposed. A new paragraph should be added to this Part to establish an inspection program for plugged and abandoned oil and gas wells.

Section 2.4.6 of the rdSGEIS should be revised to accurately reflect the history of New York's oil and gas industry regulation with respect to post-production plugging, abandonment and reclamation.

Section 3.2.2.3 of the rdSGEIS should be revised to clarify how the one-mile setback of HVHF projects from abandoned oil and gas wells will be implemented for abandoned wells in unknown locations.

Section 5.17 of the reSGEIS should be revised to present a scientific evidence basis for plugging standards, to prescribe standards developed in response to the evidence basis, and to describe a systematic inspection program for plugged and abandoned wells.

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