CORRUPTED DEMOCRACY, ROGUE STATE RUSSIA, AND THE RICHEST, MOST DESTRUCTIVE INDUSTRY ON EARTH

BLOWOUT

'A revelation...exposing the truth about how the fossil fuel industry threatens our existence'

DAVID LAMMY, MP

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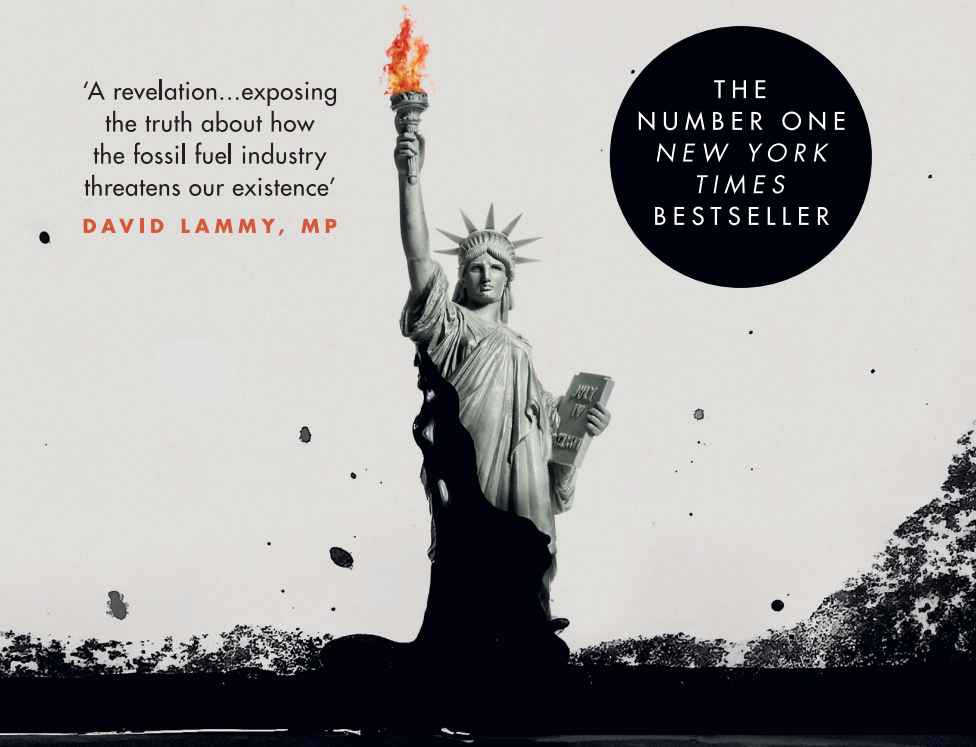

RACHEL MADDOW

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Rachel Maddow is host of the Emmy Award-winning *Rachel Maddow Show* on MSNBC, as well as the author of *Drift: The Unmooring of American Military Power*, a number one *New York Times* bestseller. Maddow received a bachelor's degree in public policy from Stanford University and earned her doctorate in political science at Oxford University. She lives in New York City and Massachusetts.

ALSO BY RACHEL MADDOW

Drift: The Unmooring of American Military Power

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Corrupted Democracy, Rogue State Russia, and the Richest, Most Destructive Industry on Earth

VINTAGE

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To the bots and trolls, all of you, with love

CONTENTS

IN A SURREALIST LANDSCAPE

The very idea of it was too implausible, too fantastical, to be believed; it was simply too outlandishly grand even for a grand opening. A visiting head of state, one of the most powerful men on the planet in the autumn of 2003, had announced his intention to be on hand to christen a tiny new franchise operation on the frowsy little corner of West 24th Street and Tenth Avenue in Manhattan.

The world potentate was in the middle of a three-day swing through New York City, on his way to a one-on-one summit with George W. Bush at the American presidential retreat, Camp David. He had spent the past few days in the august citadels of power, money, and meaning in New York; had taken private meetings with the president of France and the chancellor of Germany in his private suites at the Waldorf Astoria hotel; had delivered a widely anticipated address to the General Assembly of the United Nations; had fielded earnest questions about the benefits and the perils of democracy from scholars at the city's premier university; had bowed his head in prayer alongside religious leaders whose brethren had long ago been exiled from their shared home country; and had laid a bouquet of red carnations at a temporary memorial to the 343 New York City firefighters killed just two years earlier in the 9/11 attacks. The New York *Daily News* reporters thought they had detected an actual tear slide down the presidential cheek as he placed the floral remembrance for the dead American heroes. Now the

world leader was going to veer off this power slalom to preside over the grand opening of a business with a few hundred square feet of retail space, valued in its recent purchase at $55,000?

As the hour of the scheduled grand opening in the increasingly gay New York neighborhood of Chelsea neared, he was meeting with two dozen captains of American industry in the cavernous banquet room of what might well be considered the Royal Palace of International Capitalism—the New York Stock Exchange. Heads of the largest companies in America were on hand; the CEO of the most profitable company in the history of the modern world, ExxonMobil, had flown in from Texas to be among the interlocutors. All of which appeared to please the guest of honor. "We have been surrounded by a very kind and warm atmosphere almost everywhere we have been in New York," was his opening message, as translated to the industrial barons through the elegant headset provided to each. "It is this direct contact that allows all of us—both politicians and entrepreneurs—to open new possibilities and spheres for wide cooperation."

Three miles north, meanwhile, at 24th Street and Tenth Avenue, as the security team began to shut down surrounding streets, shoo away the occasional Rollerblader, and tape off a makeshift pen for the growing press contingent, the store's attendants readjusted their new red shirts and ball caps. Among the curious onlookers at this unfolding scene, skepticism reigned. "Nobody thinks he will come," the store manager confided to one reporter. "We are telling people. They say, 'No way.' "

But then, at around two o'clock in the afternoon, there was a wail of sirens from the south, and a boxy Eastern European–style armored limousine tucked in among a phalanx of armored vehicles came into view. The small crowd of people who craned their necks and stared south toward the motorcade also noted the sudden appearance of the senior U.S. senator from the great state of New York, there to greet the arriving limousine. This was really gonna happen. The attendants and managers readjusted their shirts and ball caps one final time. The counterman checked again to make sure that the coffee was hot and the doughnuts were arrayed in comely fashion. By the time the honored ribbon cutter emerged from behind the steel curtain of armed and armored security and walked toward the gas pumps and cash reg-

isters, local reporters were already rehearsing their ledes. "In possibly the greatest show of political power ever to attend the grand opening of a gas station," the *New York Post* would offer, "Russian President Vladimir Putin showed up in Chelsea yesterday with Sen. Chuck Schumer to help inaugurate the first Russian-owned chain of petroleum stops in America."

The *Post*'s rival tabloid, the New York *Daily News,* countered with "Fill 'er up, Vlad," under the headline "No Fueling, That's Putin."

There was a hint of pride in Vladimir Putin's open, shoulder-swinging gait as he strode across the gas station lot to shake hands with the five nervous-looking attendants, who could now be officially counted among the ranks of Moscow-based OAO Lukoil's 120,000 employees. Their uniforms, President Putin must have noted, were snappy and vibrant and matched the rest of the station decor—power red! The day was overcast and the sky wan, but the nearby credit-card-ready gas pumps gleamed under lights recessed in the new high canopy built to shield customers from the vagaries of weather and to dispense retardant chemical foam in the event of a gasoline fire.

The franchisee of this station, Paramgit Kumar, was in his glory too, and all thanks to Lukoil, the largest and most profitable oil company in Russia, a country second only to Saudi Arabia in daily production of crude. Lukoil claimed more proven reserves of oil than any publicly traded company on earth and had taken up its position at the point of the flying wedge of Russia's entry onto the new world order's wide-open field of commerce. The corporation had emerged from the dank, state-run ruins of the Soviet Oil Ministry into the bright lights of free-market capitalism, a fact recently confirmed by the company's official listing on the London Stock Exchange. Another first for Russia! Share prices of Lukoil had risen from $3.54 to $24.55 in just four years. Revenues had jumped from $15.5 billion to more than $22 billion in the previous year alone. Western bankers had enthusiastically stuck their heads into the scrum for the chance to win enormous fees for trail-bossing Lukoil's $775 million public stock offering.

Lukoil had used a wee bit of its new Western-fed capitalization to acquire the moribund Getty Petroleum Marketing Inc., with its thirteen hundred gas station properties dotting the Eastern Seaboard of the United States. That made it the first Russian company to own an

American company listed on the New York Stock Exchange. And that meant that some of the Lukoil shine had fallen on Mr. Kumar. He had been one of the first operators to grab his new parent company's offer of a loan guarantee—at way-below-market financing—to upgrade his seedy little Getty station. "[My] station is a piece of junk," one fellow Getty operator complained. "My pumps are about fifty years old." The cash infusion allowed Kumar to upgrade his pumps, his flame-retardant canopy, his Kwik Farms minimart, and his color scheme. Power red! You could see it ten blocks away. So what if the Lukoil name was new to his customers and kind of foreign sounding. The makeover and rebrand meant he had it all over his nearest competitors—ExxonMobil, Hess, and Gaseteria. "There aren't too many gas stations in New York City that are new and attractive, so we stick out," Kumar would boast to a reporter from *Convenience Store News*. "Plus, now we have a convenience store as well, which brings in gas customers and customers just walking by on the street."

Schumer had to walk quickly to stay at the shoulder of the Russian president as the two men were escorted under the new canopy, past the giant flowerpots teeming with chrysanthemums, toward the convenience store tucked back in the corner of the lot, under the hulk of what used to be elevated train tracks. Putin kept his head bent away from Senator Schumer as he made his way toward the soda-pop-and-cigarette wiles of the Kwik Farms. The Russian president was instead listening intently to the gentleman on his right, a beefy executive in a dark suit, with a head of gray hair cropped tight and neat in the old Soviet military style. This was the CEO of Lukoil's worldwide operation, Vagit Alekperov, who had flown in from Moscow for the opening.

Alekperov was a welcome sight for Putin, a man he knew he could count on. There were other tycoons back in Moscow more able in the area of high finance, more schooled in the Western-style corporate governance that international investors now demanded, and more adventurous in developing and deploying expensive new technologies for extracting crude oil and natural gas from Russia's vast and waiting reserves. But there were risks in being too keen. Putin had seen too many Russian businessmen whose heads had been turned by the enormous financial possibilities in oil and gas, who had become eager to invite American and British oil majors in to develop the Russian fields. He

worried men like that might accidentally give away the store. But Vladimir Putin did not worry about Vagit Alekperov, who had come up among the roughneck ranks in the Soviet oil fields in Azerbaijan, managed fields in western Siberia, and served as the youngest-ever deputy head of the Soviet Ministry of Energy when it was overseeing production of more barrels of crude per day than any country in the world, single-handedly meeting the U.S.S.R.'s daily energy needs, financing the Soviet government and its ruling Communist Party, and providing both energy and necessary cash to the worldwide span of Soviet satellites and friends.

By 2003, of course, the Soviet Union was no more, but Alekperov retained his sense of mission from the old superpower days. He was still a dedicated patriot. Russia's coat of arms enjoyed a place of pride on his office wall back in Moscow; a black-and-white headshot of Vladimir Putin was the lone photograph on his orderly titanium-and-glass desk. The imperatives of the Russian Federation and its president were never far from mind. The move into the retail gas market of the United States, for instance, was likely to be a losing financial proposition for Lukoil, but Alekperov understood that his duties as CEO of the country's largest oil company were not merely fiduciary. He understood the geopolitical and symbolic importance of this move into the American market, and he understood the need to support the aims of the Russian president. "It is impossible to divide the interests of a country and a company that works on its soil," Alekperov told the American reporter Peter Maass, who was working up a profile of the oil baron for *The New York Times Magazine*. "Our interests are the same. What's good for Russia is good for the company."

Alekperov had been on hand at the New York Stock Exchange just an hour before his arrival at the gas station and had heard Putin sing his song of Russian success to a handful of America's corporate luminaries. "In the first half of this year, in comparison with the equivalent period last year, the volume of GDP increased by 7 percent, industrial production by 6.9 percent, and investment by almost 12 percent," Putin told the group. Russia's economic growth topped world averages year after year, he boasted. "It must be noted that the results achieved are not just thanks to the favorable internal economic situation but also growing entrepreneurial and investment activity. These figures can be

attributed to the structural reforms taking place in Russia and the general improvement of the business climate in the country." Putin went on to reiterate his recently announced goal of doubling Russia's GDP in the next decade.

"I am certain that the personnel, scientific-technical, and rich natural potential of the country, combined with new economic and civic freedom, should give us the desired result," Putin said. "I am certain that we have every justification to also expect a breakthrough in Russian-American business partnership."

The cornerstone for the construction of that international partnership was to be oil and gas. Which meant Russia's Lukoil beachhead on that unprepossessing corner in Manhattan was more than just a gas station. More, even, than a gas station with a Kwik Farms convenience store. Sometimes sharing coffee and Krispy Kreme doughnuts—"He ate a glazed," Schumer told reporters about Putin—can portend something bigger. Was this little chat and chew the time and place where the Cold War would commence its final, satisfying melt?

President Putin was there at the gas station in 2003 to convince all New Yorkers, and all Americans, that Russia could deliver stability and reliability at a time when America really needed that, or at least craved it. It had been just a few months since the U.S. military had toppled Saddam Hussein in Iraq, and Americans were becoming once again attuned to the danger of being too dependent on Middle East–dominated OPEC, which supplied nearly half of America's crude oil and seemed to be able to control prices at will. American consumers had watched helplessly at the end of August, in the waning weeks of summer vacation, as gas prices at the pump skyrocketed at the fastest rate in nearly fifty years. Los Angeles had absorbed a 30 percent hike; in Phoenix, it was 40 percent. American consumers were paying more than $2 a gallon for the first time ever.

There were other factors at play, but some Americans apprehended this price hike as an OPEC plot, payback for putting American boots on the ground in a sovereign state in the Middle East. The announcement that OPEC would cut production by nearly a million barrels a day—made just a few days before Putin's arrival at the Kwik Farms doughnut counter—seemed to confirm the fear. American gas prices were certain to keep going up, at least as long as OPEC had us on such

a short leash. Thank God for Russia. Thank God for the honeypot of known oil reserves in western Siberia, not to mention the vast untapped reserves off Russia's Arctic shelf. Lukoil had five Arctic-ready, icebreaking oil tankers on order at that very moment—an investment of nearly $200 million. And Vladimir Putin had pronounced himself ready to provide America's new not–Middle Eastern fuel supply, indefinitely, in exchange for a little help with the much-needed modernization of the Russian oil sector.

There was already a plan afoot, worked out among the energy poohbahs of the Bush and Putin administrations. U.S. companies would help finance a new pipeline from the oil fields in western Siberia to the Russian port city of Murmansk, as well as new storage tanks there and improved deepwater facilities commodious enough for big tankers to maneuver in and out. The Russian military would give over some of its submarine berths to accommodate the big ships, and Russian oil companies would load up those oil tankers for shipment straight to the American market. Putin thought that Russia could be supplying 10 percent of U.S. oil imports before George W. Bush finished his second term in office. Maybe more. There was also talk of constructing a special new facility for exporting liquefied natural gas to America. "It's not just oil," Bush's deputy secretary of energy had said on a reconnaissance visit to Murmansk. "Natural gas is also going to be an important factor in our energy relations." Just two days before Putin arrived in New York, at the second annual U.S.-Russia energy summit in St. Petersburg, the U.S. energy secretary, Spencer Abraham, proclaimed that the United States was now prepared to "assist Russia as her role in the global energy market increases."

Even skeptical Russia watchers in America were tuning in to new possibilities. An ascendant American scholar of modern Russia—the future U.S. ambassador to Moscow Michael McFaul—was just beginning to take the measure of the new Russian president and had already warned of the risk that Putin would evolve into an autocrat who monopolized control of government and the economy behind the window dressing of democratic institutions. But despite long-range concerns, the week that Putin was in New York had McFaul feeling optimistic. He told the members of the U.S. House subcommittee charged with keeping an eye on Europe that the Russian president and his key deputies

no longer seemed to view America as an implacable enemy bent on emasculating Russia. That old antagonistic perspective, McFaul said, is no longer "the dominant view among foreign policy elites [in Russia] and is most certainly not the orientation of Putin and his government." McFaul even went so far as to voice the possibility of the most felicitous of outcomes: "If Russia consolidates a liberal democracy at home, then I have no doubt that Russia will develop into a reliable and lasting ally of the United States in world affairs." And Putin might be just the man to do it; at the very least, he seemed to be embracing the idea of Western-style capitalism: "Since becoming president, Putin has done much to accelerate Russian economic reform."

Maybe that kind of optimism about Putin had been buoyed by the story that had run the previous week in *The New York Times* about Paul McCartney's recent visit to Moscow. The old Beatle, there to do a concert and film a television special called *Paul McCartney in Red Square,* had been summoned to a private audience with President Putin, who walked him into his inner sanctum, dismissed his interpreter, and carried on a conversation in rather serviceable English. "He was fun," McCartney told Bill Carter from the *Times*. "He said, 'I really know your music.' He agreed the Beatles had been a force for freedom." Putin even showed up in person for McCartney's Moscow concert—McCartney played a second iteration of "Back in the U.S.S.R." just for him, and the crowd didn't mind one bit.

The week after that heart-warmer ran in the *Times,* Putin, Alekperov, and Schumer stood inside the Kwik Farms amid the doughnuts and soda pop and potato chips, the heat lamp on the hot dogs radiating a gentle warmth against the old Cold War chill. They didn't linger too long; there was the press corps outside, after all, waiting for a statement. Yet when the three men walked out and settled in front of the fuel pumps to address reporters, Putin demurred and said nothing. That reticence was unexpected; this was a photo op and a press availability, wasn't it?

Putin's reserve that afternoon on Tenth Avenue might have had something to do with a brief but unsettling interaction at the New York Stock Exchange, just before his visit to the Lukoil station. The Russian president had been whisked into a side room for an audience with ExxonMobil's CEO, Lee Raymond, a meeting laid out in spectacular

detail in Steve Coll's book *Private Empire*. Raymond, who seemed to believe that his position as head of the world's most profitable corporation made him approximately equal in power and stature to the president of the Russian Federation, appeared to have rattled Putin. Putin was aware that ExxonMobil had been negotiating to buy a 30 percent stake in Russia's most impressive up-and-coming privately held oil company, Yukos—a company that might one day challenge Lukoil as Russia's biggest producer of crude. What Putin did not fully appreciate before his talk with Raymond, however, was that ExxonMobil was in the habit of getting final say in all of its partnership ventures. In Coll's vivid sketch of the meeting at the stock exchange, Raymond asked for an assurance from Putin that ExxonMobil would one day be permitted to acquire a majority stake in Yukos. He more or less demanded it as a condition for moving forward. "I need to have an understanding of our ability to get to fifty-one percent," Raymond told Putin.

"That means if I want to have Yukos do something, I'm going to have to come and talk to you?" Putin asked.

"Yeah, that's not so awful," Raymond told him. "That's true in a lot of places in the world."

Coll detailed the aftermath of the meeting also: Raymond would report back to the home office in Texas that his meeting with Vladimir had gone swimmingly and that the ExxonMobil-Yukos deal was on track. Putin saw it differently. He had been offended by the American executive's arrogance. According to Leonard Coburn, a U.S. Department of Energy official who understood the enormous strategic importance of the Russian oil industry to the country itself, Putin had also been "a little scared." The Russian Federation president found himself in a bind. Without the weird parallel Soviet economic netherworld that had channeled and shielded Russia's oil and gas bounty, his country's economic future was in uncharted territory. The way things were going, the post-U.S.S.R. Russian economy would basically be entirely dependent on its oil and gas industry's ability to compete in the world market. By 2003, that meant Russian oil companies urgently needed both money and technology from the West to modernize and compete. It might have been dawning on Putin, under that bright red Lukoil canopy in New York in September 2003, that in allowing Russian businessmen—even patriotic Russian businessmen—to do business

with ExxonMobil and BP and Chevron and Shell, he risked losing his iron grip on the industry that provided the lifeblood of the Russian state.

Whatever the cause, Putin chose not to employ that rather serviceable English for the enlightenment of the reporters outside the Kwik Farms. He stood silent and nodding, with a bloodless, pursed-lip smile on his face, while Vagit Alekperov offered the sort of brief, heavily accented, to-the-point statement that makes Americans think of the cartoon characters Boris and Natasha: "Through today's action, America will have a new source of energy." Senator Schumer was more voluble about the potential partnership symbolized by the Lukoil–Kwik Farms team, five of whom were standing just over Schumer's shoulder, red ball caps ablaze. Together, the senator suggested, Russia and America were going to take on the bully. "I hope it does cause problems for OPEC," Schumer said. "I hope OPEC is hurt by this so they don't have a stranglehold on the oil market anymore." Having spent about ten minutes on-site, Putin was then swept up into his armored motorcade, and he and his entourage sped off toward the summit at Camp David.

It was hard to tell just what the local civilians who had happened onto the scene made of the entire Lukoil grand-opening exercise. Some were distracted by the curtains in Putin's limo, one by a full-on machine gun he was sure he saw mounted in one of the SUVs in the Russian motorcade, others by the Russian president's physical stature. Putin was, well, surprisingly tiny. "Diminutive" was how the *New York Post* put it. And yet he struck one woman, even in his diminutiveness, as "rather totalitarian." Leave it to that paragon of workingman's New York, the taxi driver, to offer up the most clear-eyed and incisive take on the strange event. "I know nothing about [Putin]," the cabbie said idly, while filling up his tank at the new Russian-owned pumps. "If he's going to put the gas cheap, then I'm going to know about him."

We all know how it turned out, looking back from the vantage point of 2019. In the end, Vladimir Putin didn't ever put gas cheap. After a ten-year life, the once-celebrated Lukoil station at 24th Street and Tenth Avenue is no more. The property had a brief run as a public art instal-

lation called *Sheep Station*. "Set in a surrealist landscape amidst the existing industrial gas station architecture," the exhibition brochure explained, "the sheep symbolize [François-Xavier] Lalanne's mission to demystify art and capture its joie de vivre." Today, the lot is home to a glass-and-chrome luxury residential building with an art gallery on the ground floor. Twelve stories housing six $15-million-and-up condos. The condo complex is called the Getty. It skipped a generation, in other words; it was a Getty station before it was a Lukoil station before it was condos, but Lukoil has been wiped from public memory. Hopes for a world-changing American-Russian partnership—the canopy to protect us all from the vagaries of the international and political weather—have long since crumbled. As has the idea of Vladimir Putin as a force for global stability.

Turns out Putin made mistakes over the past fifteen years—big, fundamental, hard-to-reverse mistakes. That can happen when you try to build your country's future on the oil and gas industry. Putin's decisions stripped his country of its ability to compete fairly in the global economy or global politics and limited its strategic options to the unsavory list he and his apparatchiks are ticking down today. His efforts to restore Russia as a world-stage superpower no longer depend on capacity and know-how. They depend on cheating. Putin and his minions cheat at the financial markets. They cheat at the Olympics. They cheat at their own fake democracy. They cheat other people out of their democracies.

It's easy to look back on those strange days at the end of September 2003 and identify the warning signs about Putin and Russia that American policy makers missed. But it would be unfair to them and unfair to history to do so without recognizing that the way things turned out was not inevitable. There really was the spore of a bright new future in 2003. And it is certainly true that Russia itself had the resources and the capability to go in another direction. That things turned out as they did is a tragedy—a sprawling but explicable tragedy. And it is not Russia's alone.

I believe there is one narrative thread that stitches together the greater part of that tragedy—a thread that wraps its way around the globe: from Oklahoma and Texas and Washington, D.C., to London,

Kyiv, Siberia, Moscow, Equatorial Guinea, and the Alaskan Arctic; from the Arbuckle formation deep in the earth's crust to the icy surface of the Arctic seas; from a Malibu mansion stuffed with the world's largest collection of Michael Jackson memorabilia to a thousands-of-dollars-a-night luxury hotel in central London to a divorce court in Oklahoma City to a crappy office building offering its workers a "Free Power Supply!" in St. Petersburg, Russia. The saga involves, among other incidents, the purposeful detonation of a fifty-kiloton nuclear bomb eight thousand feet below the earth's surface (unsettlingly close to an I-70 exit ramp in Colorado); an international financial crisis; a twenty-eight-thousand-ton vessel dragging unmoored and unmanned onto the craggy coast of Alaska; tornadoes; the novelty of man-made earthquakes; murdered cows; and a third-grade public school teacher panhandling to provide school supplies for her students. Even an inept Russian spy ring ferreted out of suburban tract houses in New Jersey and Virginia. Even Russia's interference in the 2016 U.S. presidential election. Seems unlikely, but it all ties.

The motive force of all the action—its fuel as well as its engine—is the most consequential, the most lucrative, the most powerful, and the least-well-governed major industry in the history of mankind. Oil and gas. I do not propose to discount or minimize the powerful and positive effects the producers of our hydrocarbons have had on our own country and on the world at large. I like driving a pickup and heating my house as much as the next person, and the through line between energy and economic growth and development is as clear to me as an electric streetlight piercing the black night. But the political impact of the industry that brings us those things is also worth recognizing as a key ingredient in the global chaos and democratic downturn we're now living through.

I don't mean to be rude, but I also want to be clear: the oil and gas industry is essentially a big casino that can produce both power and triumphant great gobs of cash, often with little regard for merit. That equation invites gangsterism, extortion, thuggery, and the sorts of folks who enjoy these hobbies. Its practitioners have been lumbering across the globe of late, causing mindless damage and laying the groundwork for the global catastrophe that is the climate crisis, but also reordering short-term geopolitics in a strong-but-dumb survival

contest that renders everything we think of as politics as just theater. It's worth understanding why. And why now.

In the past twenty years, a technology-driven accelerant has been poured onto the fires of an industry that was already pretty good at burning up whole national economies and hopes of democratic governance. One signal (and unplanned) consequence of this earth-shattering leap in oil and gas production is that it stranded Russia economically and strategically, in a way that has driven Russia's leaders to distraction—and beyond. With no option now to retreat within the controlled global order of Soviet satellite states, Russia's one essential industry today has to keep up even with the West, even with the democracies. Putin knows Russia can't do it alone, but it also won't do it together—not if it has to be on the West's terms. And so the West's terms must be changed. Behold the new world disorder. Behold the foreign trolls in your Facebook feed. At just the wrong time and in just the wrong place, the worst instincts and practices of the most powerful industry on earth mapped onto geopolitics in a way that didn't just stunt the prospects for success; it turned them monstrous and backward.

This book won't catalog the whole slimy slick that the oil and gas industry has left behind it all over the world. Think of it as more of a guided tour of some of the landmarks, like Oklahoma, and Equatorial Guinea, and Russia, of course. But naturally—gnash your teeth all you want, Vlad—it all starts right here in America. It's always America.

BLOWOUT

ONE

SPLENDOR AND FRAGRANCE

If you had to point to a beginning, to the exact location of the big bang from which American industrial and economic power began its astounding and sometimes reckless expansion, it would be at the end of a percussion-driven, blunt-force drill bit, lowered through a cast-iron pipe, powered by a six-horsepower steam engine, slamming down and down and down into the earth on a farm in northwest Pennsylvania. At a depth of sixty-nine and a half feet, the operators of the drill struck what they had been looking for, and on August 28, 1859, the crude yet sublime substance—"rock oil," as it was called at the time—presented itself on the earth's surface.

That discovery, like the big bang itself, is but a subatomic pinhole in space compared with all that has followed. Edwin Laurentine Drake and his hired man, "Uncle Billy" Smith, pulled the equivalent of maybe twenty forty-two-gallon barrels of crude oil from the ground on a good day. The inhabitants of our planet weren't exactly starving for more in 1859, or at least didn't yet know they were. The first commercially viable gas-powered engine, and the ensuing addiction, were still a few generations away.

Today's drillers produce an average of more than ninety *million* barrels of oil worldwide every day, and a lot of natural gas, too, which fuels cars, jets, freight trains, ocean liners, power plants, factories, and farm machinery, as well as the economies of republics, monarchies, and dictatorships around the globe. Nearly a hundred countries,

representing six continents, are in the oil and gas game, and many have been in it for a century or more. But the United States got there first (Russia was a very distant second), and only the United States can lay claim to having shaped the industry's prevailing culture: the tools of its trade, its financing, its administration, its ethic, and its reach. "The organization of the great business of taking petroleum out of the earth, piping the oil over great distances, distilling and refining it, and distributing it in tank steamers, tank wagons, and cans all over the earth," the president emeritus of Harvard noted in 1915, "was an American invention."

In fact, it could be argued, the oil business as we know it today was the invention of one particular American, John D. Rockefeller. Rockefeller was there almost from the beginning. He created and husbanded the exemplar of the industry, Standard Oil, and along the way he helped to popularize the idea of America as the testing ground where the extravagant possibilities and the outsized benefits of free-market capitalism have been proven. Rockefeller, a junior partner in a Cleveland merchant commission house trading in grain, hay, meat, and miscellany when Edwin Drake made his strike in 1859, watched the oil business unfold up close. When he entered the field in 1863, at age twenty-three, he understood his best bet was to concentrate on refining the crude oil and to leave to others the rather messy and costly process of actually getting it out of the ground.

Within ten years, Rockefeller had managed to get control of nearly all of the oil refineries in Cleveland, which had established itself as the nation's main refining center. Rockefeller's new corporation, Standard Oil, shipped a million barrels of refined oil in a single year. By 1875, thanks to the fire sale that followed the first frightening financial panic and depression in industrialized America, Rockefeller had taken control of every major refining center in the country. "We were all in a sinking ship," he would later explain, "and we were trying to build a lifeboat to carry us all to shore. . . . The Standard was an angel of mercy, reaching down from the sky, and saying 'Get in the ark. Put in your old junk. We'll take the risks!' "

Standard Oil's main product at the time was kerosene, which proved a welcome innovation in illumination. It was efficient, effective, plentiful, and reasonably priced. The most widely used lighting oil at

the time, which was struck from soft coal, was dirty; whale oil was hard to get (see *Moby-Dick*) and dwindling in supply; kerosene from petroleum—or rock oil—was just the thing to illuminate the clean, bright new future. "Rock oil emits a dainty light," promised the new industry. "The brightest and yet the cheapest in the world, a light fit for Kings and Royalists and not unsuitable for Republicans and Democrats." Farmers and city dwellers could afford to read well into the night. Factory owners could afford to keep their works open around the clock. Rockefeller's magic potion was a worldwide phenomenon; in 1875, before any European-based company was producing kerosene in bulk, 75 percent of the output from Rockefeller's American refineries was loaded up and shipped overseas. Cash flowed back across the Atlantic. Standard's production capacity grew year after year. The efficiencies that followed—economies of scale—allowed Rockefeller to cut the cost of refining by more than 85 percent and to cut the cost to the consumer by 70 percent. Demand swelled, and so did revenues.

Rockefeller's company, meanwhile, just kept eating would-be competitors. About 90 percent of America's crude flowed through Standard Oil by the end of the 1890s. The company had money and means to produce its own crude, and refine it, and get it shipped to market on its own (always favorable) terms. Standard was capable of controlling the price of oil and railroad freight rates and had cash in the bank to pay off the state and federal legislators who wrote laws governing the industry. "John D. and his colleagues regarded government regulators as nuisances to be bypassed wherever possible," says Rockefeller's estimable biographer, Ron Chernow. "He felt that politicians were basically parasites who would shake down businessmen. I mean, all of this bribery he saw as extortion; that is, the politicians shaking him down, rather than his paying off the politicians. . . . I think he regarded these payments really as a business expense."

Standard Oil eventually grew into "the largest business empire on earth," according to Chernow. "I don't know that the business world has ever seen an agglomeration of wealth and power on the scale of Standard Oil." This was the era of consolidation, of the Big Trust, which was nineteenth-century parlance for monopoly—the Sugar Trust, the Beef Trust, the Steel Trust, the Tobacco Trust, the Rope-and-Twine Trust. But the Rockefeller-controlled Oil Trust was the first, the

biggest, the most powerful, and easily the most talked-about trust in the country. Rockefeller himself stood with Andrew Carnegie (steel), Philip Armour (meat products), and James Buchanan Duke (cigarettes) as the richest and most powerful commodity producers on the continent. They sat on mounds of private wealth unimaginable in the young republic at the time of Rockefeller's own birth. John D. died nearly fifty years before the debut of the *Forbes* 400, the annual listing of the wealthiest private individuals in the country. But when the editors of a book timed to coincide with the twenty-fifth-anniversary edition of that list made some calculations, they declared Rockefeller the richest single individual in the history of America. They figured his peak net worth at $305 billion (in 2006 dollars), which means that if John D. were to be magically reanimated today, with his peak fortune still intact, his personal wealth would roughly triple that of the whippersnapper who sat atop the *Forbes* list in 2019.

Millions of barrels of ink have been expended in trying to explain the reasons for Rockefeller's spectacular achievement, to reveal the cardinal (and perhaps replicable) tactic, to pinpoint the specific innate genius that made it all happen. Theories abound. Take, for instance, what could be called the Bung Theory. A bung is the stopper once used to seal up a barrel of oil, and Rockefeller's intense interest in this unromantic industrial cog, his keen watch on the monthly bung count, offers a tantalizing lead on the secret to his success. "Your March inventory showed 10,750 bungs on hand," Rockefeller once wrote to one of his foremen. "The report for April shows 20,000 new bungs bought, 24,000 bungs used, and 6,000 bungs on hand. What became of the other 750 bungs?" Maybe the key was pinching every penny! John D. Rockefeller wasted nothing, see, so he could push his costs down, undercut all competitors on price, and drive them out of the business, or at least into Standard Oil's angel of mercy ark.

Then there is the well-traveled Great Monster Theory. "Run, children, or Rockefeller'll get you," was a threat that could strike terror in the Pennsylvania oil patch in the late nineteenth century. The Great Monster Theory gained much currency in the popular mind after Ida Tarbell's remarkable series of investigative articles published in *McClure's Magazine* beginning in 1902, "The History of the Standard

Oil Company." Tarbell, who grew up in the patch, itemized the more than thirty years of Rockefeller's underhanded, corrupt, predatory behavior that constituted his effort to wipe the field of competitors. He was, in Tarbell's rendering, a rapacious and devious villain. Widows and orphans, beware. It didn't hurt that Rockefeller, aged sixty-three at the time of publication, looked ready to inhabit the villain role by then. He was already growing thin and pinched—and worse. "He suffered from something called alopecia. In 1901, he lost not only all the hair on his head; he lost all body hair," Chernow explains. "Ida Tarbell came along a year later, did this series portraying him as a monster. And since he was hairless and suddenly looked old—and ghoulish—his appearance seemed to ratify what she was saying in the series, so that the timing was particularly unfortunate for Rockefeller."

There is also the Man of His Times Theory. Rockefeller, this theory posits, was simply playing by the very loose set of rules of his day, just like everybody else was. The boundaries of capitalism and democracy in America were still being chalked, the rules of the game still being written. The prevailing ethic was best summed up by one of Rockefeller's early partners, Henry M. Flagler, who kept a copy of this little ditty on his desk: "Do unto others as they would do unto you—and do it first." The point of the free market was not to compete but to win. "The most serious charge that can be laid at [Standard's] door is that it has succeeded," wrote an oilman who felt compelled to sell out to Rockefeller in the 1880s or suffer the consequences. "It has outwitted its competitors who sought to play the same game but had not so thoroughly mastered the art. . . . In the business battle, the extremity of one is the opportunity of the other. . . . It is the rule of our competitive life that the time when the business rival is on the downward road—when creditors are pressing him hard, when banks are clamoring that he shall meet his paper, when the sheriff is threatening to close his doors—this is the opportunity for the other rival to strike the finishing blow and make merchandise out of the misery of his fellow-man." Rockefeller's eldest son and heir offered an exceedingly aromatic metaphor to justify this need to (occasionally, of course) rely on cutthroat tactics. "The American Beauty Rose can be produced in the splendor and fragrance which bring cheer to its beholder only by sacrificing the early

buds which grow up around it," John D. junior sermonized. "This is not an evil tendency in business. It is merely the working-out of a law of nature and a law of God."

Rockefeller himself had a number of pet theories about his spectacular rise. A devout and puritanical Baptist, John D. was certain there was a higher being at work. "I believe the power to make money is a gift from God," he explained to one writer, "just as are the instincts for art, music, literature, the doctor's talent, the nurse's, yours—to be developed and used to the best of our ability for the good of mankind. Having been endowed with the gift I possess, I believe it is my duty to make money and still more money, and to use the money I make for the good of my fellow man according to the dictates of my conscience."

These various theories, and the many others in circulation, are not mutually exclusive. The whole truth of John D. Rockefeller is complicated and involves pieces of them all. But the rock-bottom fact on which everything else rests is actually quite simple: Standard Oil just kept turning out the finest product on the market, at the lowest price to the consumer. *Ka-ching!*

By the first decade of the twentieth century, Standard Oil was so powerful it was pretty much writing its own rules; neither the federal government nor the various state governments were capable of reining it in. Rockefeller and his corporation were, demonstrably, beyond governance—a situation that raised alarms in a democratic republic purportedly constituted of free men, dedicated to the idea of equality. To some, it seemed, well, un-American that this extraordinary bounty of natural resources—in all its "splendor and fragrance"—should be fenced off in someone's private preserve. In 1911, about forty years after Rockefeller embarked on his quest to dominate the oil business and about twenty years after he got there, the U.S. Supreme Court ruled that Standard Oil was running a conspiracy in restraint of trade that had attempted to monopolize the interstate oil industry. And had largely succeeded. In his majority opinion, Chief Justice Edward D. White wrote that it was clearly Standard's "intent and purpose to maintain the dominancy over the oil industry, not as a result of normal methods of industrial development, but by new means of combination

which were resorted to in order that greater power might be added than would otherwise have arisen had normal methods been followed."

As a remedy, the Court ordered Standard to split itself into about three dozen distinct firms that would be forced to compete with one another. Rockefeller, who retained ownership in all the spin-offs, found this arrangement surprisingly salubrious. The separate companies *all* flourished. John D. wound up a richer man after the breakup than he was before. And even today, more than a hundred years later, the major non-state-run international oil companies we know best—ExxonMobil, Chevron, BP, Marathon—have their roots in Standard Oil and trace their ancestry directly back to Rockefeller. Standard DNA is shot through the oil industry, as are Standard's dominant traits: a penchant for pinching pennies, an eagerness to devour and expand, a mistrust and even hatred of government regulation, a vaguely delusional sense of higher calling, and a wary respect for innovation. Worth keeping these traits in mind, because they've gone on to shape the modern world. They still function as a character sketch—or maybe a psychological profile—of the richest, most powerful, and most destructive industry on the globe.

In the century or so since the Court-mandated breakup of Standard Oil, technological innovation has been the main agent of renewal in the industry and has created entirely new fortunes. Take, for example, the Koch family, famous for funding right-wing causes and politicians across the country. Koch Industries today is the second-largest privately held corporation in the United States, encompassing everything from commodities trading to cattle to paper pulp, but the corporation owes its honest-money beginnings to invention, to petroleum engineer Fred Koch's discovering a better and cheaper method for making gasoline from crude oil, back in the 1920s.

And consider the story of the field engineer in Texas who perfected a toothy rotary drill bit that dramatically improved the ability to drive through underground rock. He made himself a star in the oil patch. The Sharp-Hughes bit (advertised as "A Friend to the Driller") ultimately made that engineer's son, Howard Hughes Jr., the richest man in the world for a time.

And consider the story of Robert S. Kerr, who built Kerr-McGee and made his own fortune by proving that you could stick a drilling rig

out in the water, beyond sight of land, and suck oil up through the seabed. "Spectacular Gulf of Mexico Discovery" screamed a headline in *Oil & Gas Journal* in 1947, when Robert S. Kerr made good. "Possible 100-Million Barrel Field—10 Miles at Sea."

Most of us laymen have only a vague understanding of the science of oil and natural gas. Our fuels of choice started as living organisms hundreds of millions of years ago (Sinclair's Dino logo notwithstanding, oil is not from dinosaurs). And then over time—a lot of time—all that eons-old organic matter got covered up, deep in the earth's geologic layers, packed into an intensely hot and pressurized cauldron, where it was all boiled down, remarkably, into the stew we modern creatures use to power our daily existence. Fossil fuels! The popular vision is of a vast worldwide web of subterranean lakes and caverns filled with oil and gas. Enterprising people figure out exactly where a big pocket is, stick giant industrial straws into the ground, suck it dry, and then move on to the next one. And the world is lit. Voilà.

But the truth is, there aren't really giant underground lakes or even puddles filled with Jurassic Juice. Most of the hydrocarbons we want are spread through layer upon layer of what looks like nearly impermeable underground rock—in very tight little micro-crevices. The capture of fossil fuels is less like sticking a straw into a Big Gulp schooner and gently drawing it out, and more like sticking that straw into a sponge and having at it. Try them both some time. It's not too tough to drain the Big Gulp, is it? The extraction from the sponge requires considerably more, well, brutish effort. Things could tend toward violent. And this understanding of the need for near-violent force has driven most of the successful (a.k.a. lucrative) innovations in the oil industry. Big technological advances are not made by PhDs in white lab coats. Innovation in the oil and gas industry is rarely about quantum mechanics or higher math. Innovation in oil and gas is about brawn. So it stands to reason that the shale gas revolution of the early twenty-first century was made possible by a pair of innovations that relied largely on pure brute force. And, as you might expect, that amount of industrial-scale pushing and shoving can produce some magnificent collateral damage along the way.

TWO

THE GENIE

It was August 1969, less than three weeks after Neil Armstrong put the first footprint on the moon. Americans were just getting used to thinking of the world as our oyster; now maybe the sky and the stars were included too. And with Project Rulison in Garfield County, Colorado, the public affairs office of the U.S. Atomic Energy Commission signaled the start of yet another bold new adventure—another U.S. taxpayer–backed world first. The press release detailed the itinerary, from the D-day Minus Two instructions for the registration of official visitors at the Ramada Inn in nearby Grand Junction, to the final luncheon, where "a preliminary post-detonation briefing is planned." The thirty-six families who lived within a five-mile radius of the blast site had already been advised to evacuate temporarily; they'd be allowed back in after, as soon as everyone was sure it was all safe. The state game commission had cautioned hunters and fishermen "not to venture" into the area. The AEC had determined an optimal detonation time after consulting with local officials as to the normal daily traffic patterns on the nearby railroad tracks and nearby I-70 and as to the local school bus schedule. Sure, there would be hassles and headaches, and perhaps even a little property damage in the immediate (and maybe even not so immediate) surroundings. But if this industrial experiment proved out, it would be another problem solved—another big-thinking American triumph—thanks to the magic of science.

The problem that Project Rulison was designed to solve was especially frustrating to Austral Oil Company, owner of the rights to the natural gas deep in the Mesaverde formation in Colorado's Rulison Field—natural gas it had been unable to get out of the ground. Austral knew there was plenty of gas at that site, but it was all locked up in an impermeable shale formation, and in 1969 nobody had found a workable method of sufficiently fracturing all that tight rock to loose the bounty within. Austral was sure it was sitting on about 8 *trillion* cubic feet of natural gas in the Rulison Field and that there was another 100 trillion cubic feet in the surrounding basin. The U.S. Bureau of Mines estimated that the Rocky Mountains held a total of 317 trillion cubic feet of natural gas, enough to fuel the entire country for twenty years! And much of it was on government-owned land. Royalty payments might swell the U.S. Treasury by as much as $4 billion, Project Rulison's cheerleaders noted, if somebody would only figure a way to get at all that gas. And time seemed to be of the essence. The world population was growing every year, and so was its energy consumption, especially here at home. The United States accounted for 6 percent of the earth's population in 1969 but consumed 35 percent of the total global energy output. "[Natural] gas, which is the cleanest of all fuels, is in short supply and growing more critical," explained an Austral executive. "Something must be done to make more gas available to the constantly increasing market."

Happily, Austral had a willing partner in this enterprise: the U.S. Atomic Energy Commission. Austral agreed to pony up about nine-tenths of the $6.5 million cost of the "exploration" project, and the AEC provided the sorts of things a private oil company in Houston could not, like uranium and plutonium and detonation fuses and special devices for measuring radioactive fallout. The Project Rulison guys were so sure this new fracking adventure would work they were already promoting it as America's next big technological leap even before they tried it: "Since our society is constantly clamoring for more nonpolluting energy, we advocate vigorous efforts to bring the new technology of nuclear stimulation to rapid commercialization." You read that right. Nuclear. Stimulation. Why go straight to the old derricks and drill bits when you have the option to start with an atomic bomb, to loosen everything up? Faster, tidier.

Late in that summer of 1969, the separate components of an atomic bomb were driven by "specially equipped government vans" to surface ground zero, a.k.a. the Austral wellhead in Rulison, about five miles off I-70. SGZ was already fenced off and under armed guard, courtesy of the private contractor Wackenhut Services Inc. But the project manager, in his wisdom, instituted an extra layer of security. "Final assembly of the explosive was accomplished under 'Buddy System' controls in the Wellhead Building in the fenced exclusion area," he detailed in his final report. "The 'Buddy System,' or two-man concept, was utilized for protection of the nuclear explosive upon arrival and until detonation." Sure, one guy might screw up or go nutty when faced with the responsibilities of handling a nuclear bomb, but that's what his buddy was there for. So, *two* guys, not one: that was the safety plan. Once the bomb was assembled, Austral became, for a brief interval, proud owner of a 1,250-pound, 43-kiloton nuclear weapon. A weapon nearly three times the power of the bomb that incinerated the interior of Hiroshima and killed nearly half of its 300,000 residents.

Important as it was to Austral and the rest of the oil and gas industry, the success of Project Rulison was perhaps just as important to the AEC and its Atoms for Peace initiative. Not long after the United States exploded its second nuclear bomb over another densely populated Japanese city in August 1945, putting a final destructive exclamation point on the World War II civilian death count, the AEC had launched its effort to keep the scientific momentum going, but hopefully in a less deadly direction. A number of the young physicists and chemists who had helped develop the weapons dropped on Japan felt some ethical pangs, even as they were assured the moral scorecard was all in their favor. Dropping the atomic bombs had saved millions of other lives that would have been lost had the war been prolonged, American politicians insisted. But the casualties in Japan continued to pile up in the weeks and months after the war as thousands more died from the effects of radiation poisoning. The general in charge of the U.S. nuclear weapons project sought to ease the national conscience, telling senators in November 1945 that victims of radiation exposure die "rather soon, and as I understand it from the doctors, without undue suffering. In fact, they say it is a very pleasant way to die." More than a dozen years after the bombings of Hiroshima and Nagasaki, the body count

was still climbing. Long-term studies had confirmed that people exposed to high doses of radiation were dying from cancer at extraordinary rates. Survivors who had been nearest the blast zone were thirty times more likely to develop leukemia, according to a study done in the late 1950s.

By then, though, Atoms for Peace was in full swing in the United States, in terms of both discovery and publicity. American scientists and engineers had brought the world previously unimaginable nuclear devastation and human catastrophe, but now those same scientists and engineers were working toward nuclear applications in energy, medicine, agriculture, and transportation. All for the good. And America's most revered storyteller was on the case. In January 1957, *Walt Disney's Disneyland* television show devoted an entire hour to a Tomorrowland episode called "Our Friend the Atom." The story of the atom was like a "fairy tale," Disney's team explained. Specifically, the one where the fisherman casts his net and pulls up a bottle with a big scary genie inside. After Hiroshima and Nagasaki, "the atomic genie was freed, and his devastating force posed a fearful threat," the narrator explained. "We are like the fisherman. When he first beheld the frightful form of the genie, he too wished that he had never found the vessel. But our fable had a happy ending. The fisherman had his means of making a friend of his enemy. And fortunately, science has its way of doing the same thing. . . . It lies in our own hands to make wise use of the atomic treasures. Then the magic touch of the genie will spread throughout the world and he will grant the gifts of science to all mankind."

By 1969, with the Atomic Energy Commission spending more than half its budget on nonmilitary uses of nuclear power, the gifts were already beginning to move from the theoretical to the practical. A big one was the advent of nuclear reactors for producing electricity, which the head of the AEC, Glenn Seaborg, promised could stave off a coming crisis. "At the rate we are currently adding carbon dioxide to our atmosphere (six billion tons a year), within the next few decades the heat balance of that atmosphere could be altered enough to produce marked changes in the climate—changes which we might have no means of controlling even if by that time we have made great advances in our programs of weather modification," Dr. Seaborg told a commencement audience in San Diego. "I, for one, would prefer to con-

tinue to travel toward the equator for my warmer weather rather than run the risk of melting the polar ice and having some of our coastal areas disappear beneath a rising ocean." It was 1966 when he gave that speech.

The head of the AEC was touting the development of portable nuclear plants and nuclear power plant barges that could be towed to emergency sites after a tornado or an earthquake or a hurricane. The commission was also at work on a nuclear-powered deep submergence research vehicle to open what Seaborg called the "new frontier of inner space," which was actually the vast ocean depths, which might hold billions of tons of copper and gold and uranium. "When it comes to extracting and processing these and the many more valuable materials in the sea and the ocean floor," Seaborg promised in 1967, "the extensive use of nuclear power will probably become essential."

The AEC was also developing some nifty outer space technology, like rocket engines powered by a launchable nuclear reactor. The mini reactor—the size of your average office desk and able to produce more power than Hoover Dam—would provide the propulsion necessary for interplanetary travel. There was research into atomic-powered supersonic jets (New York to London in thirty minutes!), and trains, and even automobiles. Nuclear cars? Really? An atomic-powered merchant ship was already churning through the high seas. There were studies on how to use controlled doses of radiation to keep meat, fruits, and vegetables fresh. We might double the shelf life of everything from a porterhouse to a peach with just the right amount of radiation. We still do that, to this day, by the way. The FDA says it's especially effective for crustaceans and alfalfa sprouts. Look for the international symbol for irradiation, the Radura, on your local crawdad.

Project Rulison fell under a specialized subset of the Atoms for Peace program, a bold attempt to harness the power of atomic bombs for industrial purposes—not just atomic energy, but the actual weapons themselves. This operation was named after a passage of the Bible, Isaiah 2:4: "They shall beat their swords into plowshares, and their spears into pruning-hooks." (The AEC wisely chose Plowshares, and not Pruning Hooks, for the project name.) The famed nuclear physicist Edward Teller was a big champion of Plowshares, and especially the possibilities it presented for "geographical engineering." There were

plans afoot in the early 1960s to use nuclear bombs for strip-mining, open pit mining, and quarrying; for redirecting the course of rivers and carving out giant man-made lakes; for a deepwater port in Alaska, a sea-level canal in Israel, even a new Panama canal. When you really opened your mind to the possibilities, what *couldn't* be done with nuclear bombs?

Dr. John Gofman, head of the Biomedical Division of one of the AEC's key labs, tried to pump the brakes. Even just nuclear testing had already introduced potentially harmful levels of radioiodine into the fresh milk supply in Utah. He wasn't at all comfortable with the Federal Radiation Council's fix for that problem, which was simply to recalibrate its own edict on what constituted an "acceptable health risk." The FRC, Gofman lamented, "solved it by announcing that the safe level of radioiodine in milk was three times higher than they thought." Gofman was acutely aware of the long-term effects of radiation. Two of his colleagues in a wartime weapons lab had died of leukemia, way too young. "In about 1965, I decided that I ought to talk at the Directors' meeting on the Panama Canal," Gofman explained in an oral history years later. "I said, 'The conclusion of our Biomedical Division is: The idea of digging the Panama Canal with hydrogen bombs is biological insanity.' Edward Teller was unhappy but nobody else said a word about it."

The AEC directors didn't do anything about it either. Gofman later explained that he and his Biomedical Division became known around the commission as "the Enemy Within." The AEC directors and scientists were more comfortable with the can-do thinking of the deputy chief of staff of radiological health at the U.S. Public Health Service. Dr. James Terrill told a symposium on public health and nuclear explosives, "The potential applications of atomic energy are many and varied indeed. . . . As meritorious as clean air, clean water, and clean food may be, the term 'clean' must be translated into criteria and standards." In other words, what was clean, really, and who could say?

In 1969, as Terrill was making those kinds of public statements, and despite Gofman's warnings against it, the nuclear excavation of a second Panama canal (or maybe a Nicaraguan canal?) really had become a serious discussion in the Under Secretaries Committee at the Na-

tional Security Council in the White House. According to Seaborg, though, the thinking of the undersecretaries was that they should maybe execute a couple more nuclear test shots before giving any final go-ahead to start using nuclear bombs to cut a new hole clear across Central America. They were all watching Project Rulison, of course, to see how that turned out in Colorado. And so was President Richard Nixon, who explained his feelings to the AEC chief, Seaborg, just eight days into his first term in January 1969. "[President Nixon] said he has a special prejudice for this program—the way all people have special quirks and prejudices," Seaborg later wrote. "He thought this was something that should be accelerated."

Project Rulison had its naysayers out in Colorado, as you might expect. To effect the release of 317 trillion cubic feet of natural gas from the shale beds in the Rockies, one expert from the Colorado School of Mines told an audience at a public meeting, would require not just one big blast but more like thirteen thousand detonations of fifty-kiloton nuclear bombs. Nobody could really be certain how much radioactive effluent—people in Garfield County, Colorado, were becoming familiar with radioisotopes such as krypton-85 and tritium—would be floating in the natural gas, or left at the site once the gas was extracted. They weren't much calmed by an AEC spokesman who tried to explain away the relative dangers of radioactivity by comparing it to iodine. Of course you wouldn't drink it "straight from the bottle," but "one drop diluted in a glass of water is harmless . . . even kills germs."

A lawsuit filed by a concerned citizens' group delayed the Rulison blast until early September 1969. Weather delayed it another week, because AEC technicians worried that any radiation vented into the air by the explosion might be carried into population centers by high winds. And then, on top of everything, when D-day finally came, on September 10, 1969, there were protesters in the mountains near the blast site. When the Atomic Energy Commission spokesman had announced that the agency's abiding interest in public health and safety would forestall detonation if anybody was in the quarantine zone, local hippies and environmentalists had taken that as an invitation. Chester McQueary wrote about it twenty-five years later for *High Country News*. "We scattered over the mountain in twos and threes, so that we

could not all be removed in one fell swoop by authorities," he wrote. "At 30 minutes before blast time, we set off smoke flares to confirm for AEC officials that we were still on the mountain and inside the quarantine zone. A blue, twin-rotor Air Force helicopter soon hovered fifty feet above the aspen clearing where Margaret Puls and I stood." McQueary says that although some of his fellow protesters were yanked off the mountain at gunpoint, that blue Air Force twin-rotor couldn't land easily on the steep slope where he and Puls had set up camp, and the chopper let them be. He told one interviewer that an airman on board flashed him a peace sign as the helicopter flew off.

The protesters had consulted a geologist who told them that when the detonation countdown started, they should get away from cliff faces that might fall or large trees or boulders that might bounce. They should prepare their own bodies for the blast as well. "We lay down positioned so our feet, knees, and arms would absorb the shock and motion," which basically means they got into push-up position, or the dreaded "plank." "Then a mighty WHUMP!" McQueary remembered, "and a long rumble moved through the earth, lifting us eight inches or more in the air. We felt aftershocks as we lay there looking at each other, grateful that we were still breathing and all in one piece. Seismic detectors at the National Earthquake Center in Golden registered 5.5 on the Richter scale."

The jarring seismic motion shook the liquid tanks at the nearby Union Carbide plant so badly that the chemical manufacturer had to shut down for three hours to unclog drains. A rock slide took out the Denver & Rio Grande Western Railroad's signal system, but it was quickly restored. Damage to local structures was what the Rulison project manager called "of a minor nature and center[ed] around cracked walls and ceiling plaster, cracked and broken chimney bricks, broken windows, lamps and the like."

The pre-shot estimates envisioned more than 400 damage claims, for which Austral had budgeted $200,000. But the big fears were not realized. The two nearby dams escaped uncracked. I-70 had not been damaged by rock slides. Austral did end up paying a total of $110,000 on 322 separate claims, including $124.50 to a "nonresident hunter" who had been miffed at being forced off the mountain on detonation

day. The protesters who had been taken off the mountain by force were released without charges. "There have been no reports of injury to people or livestock," the AEC reported to Congress's Joint Committee on Atomic Energy.

The bomb was exploded 8,426 feet beneath the earth's surface, where it vaporized enough rock to open a 300-foot-high, 152-foot-wide cavern. The "fracture zone" radiated out 433 feet. The team had to wait a few months to allow the giant new cave to cool down and the detonation-produced radioactivity to decay a little. But it soon seemed apparent that our new friend, the atom, had performed an industrial miracle. That gas was stimulated! In 108 days of flow testing, according to the Project Rulison Manager's Report, the "volume is the equivalent of approximately 10 years of production from a conventionally stimulated well in the Rulison field." The report noted "very little flow restriction through the penetrated fractures, thus confirming that an effective path between the chimney and the reentry wellbore had been established." Mission accomplished! Almost.

Turned out there were two problems. First and most fundamentally, this new method of drilling-for-gas-by-atom-bomb left the gas itself enhanced by its nuclear experience. "Mildly radioactive" was how the scientists put it, contaminated with krypton-85 and tritium. But—here's the second problem—it was hard to say just how much tritium was in the gas (or at the blast site), because the machine the scientists had brought to measure krypton and tritium contamination, a machine referred to by the excellent acronym STALLKAT, didn't actually work. In the otherwise cheery 265-page Project Manager's Report on Rulison, this was the part where a little palpable sadness crept in. "Though certain drawbacks with STALLKAT were readily seen, not the least of which was a poor sensitivity to tritium, it was clearly the best available system." You go to the bomb site with the STALLKAT you have, not the STALLKAT you might want or wish to have at a later time.

The project manager noted that "some quite active tritium material fell near the base of the stack early in flaring" and that the bomb site also tended to get littered with tritium when it snowed. But nobody honestly knew how much tritium that little slice of Garfield County

had just been saddled with, because the damn STALLKAT couldn't sniff it out. Under "Recommendations," the project manager was blunt: "The STALLKAT should not be used for monitoring tritium."

Now, from a public relations standpoint, the mystery of just how much radioactive contamination Project Rulison had burped up into Colorado was a problem that might have been overcome. Once they started to get reasonable measures of how much radioactivity was actually around, public health officials could always just raise the level of radioactivity that was considered safe for humans—problem solved. That's how it worked with the hot milk in Utah.

But for all its technological dynamism, the cost-benefit balance of the program was daunting. It was going to require more and bigger bombs to make bigger caverns and greatly expanded fields of fractured rock if nuclear stimulation was going to be commercially viable. And atomic bombs don't come cheap. The boys at the AEC retained their can-do attitude, buoyed by the country's accelerating energy demand and by President Nixon's quirks and prejudices. He wanted more natural gas, in a hurry, including the bombed kind. Nixon's 1971 report to Congress on energy issues included the promise of more "nuclear stimulation experiments which seek to produce natural gas from tight geologic formations." In 1973, the AEC tried again in Colorado, in Project Rio Blanco, where this time it was *three* thirty-three-kiloton nuclear bombs, detonated simultaneously, at three separate depths within 851 feet of one another. Radioactivity increased. Commercial prospects did not.

In all, these gas-happy experiments cost about $82 million. The accountants figured that at the assumed rate, even with costs coming down, even if they took that entire coveted 317 trillion cubic feet of natural gas, the best they could hope to recover was about 40 percent of the cash outlay.

And so died our nation's experiment in nuclear fracking, way back in 1973, after four glorious years of trying really, really hard.

Nuclear stimulation equipment was mothballed at just the moment when Americans were beginning to get good and jittery about the guarantee of an ample and never-ending supply of fuel sources. The