

# Pagosa Daily Post

## Saudi Arabia or Chernobyl?

Glenn Walsh | 10/1/08

In July 2005, Congress passed the Energy Policy Act of 2005. Like most dog's breakfast omnibus bills, the Energy Policy Act of 2005 included something for nearly everyone with lobbyists in Washington. Key features were tax breaks of nearly \$20 billion for nuclear, "clean" coal, and newer and older renewable technologies.

And like most omnibus bills, the 2005 Energy Act included many things against the wishes of many.

Wind, solar, wave, tidal, geothermal, biowaste and agricultural fuel and power generation subsidies were criticized as too lavish for too little return by many Republicans. While billions of subsidy for "clean" coal and nuclear research and development, including billions of guarantees for cost overruns for new plants, and regulatory exemptions from the Clean Water Act, were castigated by many Democrats as expensive giveaways to Vice President Cheney's friends.

On the surface, the state-by-state vote approving the measure conformed to the red-blue map of the 2004 Presidential and Congressional elections (which makes some sense for a democracy), but dig deeper and the actual support for most of the bill before some final vote posturing was quite decisive. At one point, 85 senators voted for a version of the bill containing over 95% of the final significant provisions. Final approval in the Senate was 74 yeas versus 26 no's, while nearly two-thirds of the House approved the final bill.

Interestingly, Arizona Senator John McCain voted against the bill, while Illinois Senator Barack Obama voted in favor the bill, characterized by Hillary Clinton as "the Dick Cheney lobbyist energy bill" during the primary campaign.

Of key interest for Colorado in the 2005 Act was the demand that the Bureau of Land Management undertake a "programmatic environmental impact study" of "geologically prospective areas" for oil shale and tar sands development.

That study was released in draft in December and is now, all 2500 pages, in final form available for review at the Oil Shale and Tar Sands Information Center.

Today, that study becomes an effective document which will guide the development — effective or not — of nearly 400,000 acres of Western Slope lands atop the world's richest oil shale reserves. Until today, a moratorium against leasing prospective Western oil shale and tar sands sites had been in place. But the first installment of the nation's massive \$3 trillion 2009 Budget does not include the extension of that moratorium.

A look at the final impact assessment for oil and tar sands leasing in Colorado, Wyoming and Utah — and particularly how we assess (or refuse to assess) prospects for oil shale development in Colorado — shows much, not least how much we are willing to assess the real benefits and costs of development of Colorado's oil shale reserves.

What if Colorado oil shales could achieve the successes and failures of Alberta oil sands development? Alberta oil sands production is nearing 1.5 million barrels per day, with projections of 4 million barrels per day within five years, and a possible 6-8 million barrels per day by 2025. Alberta's production is suffering from the greatest unmet demand for employees in the past fifty years of North American economic activity. Per capita

income in the province will soon exceed any spot in North America, not a noteworthy poor place.

Alberta will soon have more influence on global oil economics and politics than Venezuela, Iran and Libya combined, which for rationale minds is a very positive development.

And Alberta has yet to determine how it will dispose of lakes of toxic by-products of this development in a fully responsible way.

Both supporters and detractors of Colorado oil shale development are advancing rather silly arguments. Development of the oil shale reserves in the West will not provide the United States with any significant strategic tools to deal with oil-rich despotic regimes any time soon. Meaningful development of the resource — more than two million barrels per day — won't occur for twenty years.

And oil shale is not a “thousand square miles of tater tots”, a silly but effective characterization which is cited prominently on many silly but effective left-wing websites. Oil shale may contain only one-third the energy of coal, but it contains far more than corn, and people cannot eat oil shale.

Further, consider that tater tots, or oil-laden potatoes, are far from a negligible energy source. Starch-based fuels are likely to become a significant part of world energy supplies within the time-frame of oil shale development: thirty to forty years. Anyone with experience with distilled potatoes can attest to their potency. Furthermore, a 42 gallon barrel of tater tots (and these would be naturally batched, organic tater tots) at oil shale density would be worth well over \$1500 per barrel. Real Ore-Ida.

The oil shale reserves in Colorado are thick, rich (for oil shale) and luckily very deep, often over 500 feet below the surface of the Roan Plateau. Recovery of these resources in Colorado will require the development of novel, technologically advanced (but perhaps still disastrous) technology. Development in Wyoming, where shales deposits are poor, thin and close to the surface open that state to strip mining and surface baking and disposal, a process which may turn the oil shale regions of the state into a landscape from The Wump World.

Wyoming is not the focus of this article, and is left to the Lander Daily Post for examination.

The most prudent estimate of total recoverable oil shale reserves in the three western states are 800 billion barrels, more than 300% of the proven reserves of Saudi Arabia. Of course, the price of recovering these barrels will be more than 300% higher than the nearly Jed Clampett costs incurred in some Saudi fields (less than \$2 per barrel). Colorado, in the triangle between Rifle, Meeker and Rangely, possesses almost two-thirds of these reserves.

The PEIS presents the usual trio of doing nothing, doing a great deal, and doing everything. Typically, the final determination is structured as a prudent compromise. Here, the Bureau of Land Management has decided in favor of Alternative B, the doing nearly everything option, opening up nearly 2 million acres of land in Colorado, Utah and Wyoming to development of tar sands and oil shale. Within Colorado, about 360,000 acres will be open for leasing.

The BLM cautions that the decision is “not an irreversible or irretrievable commitment” to authorize any actual leases. The report attempts to emphasize that federal lands are “available for application for leasing” rather than “available for leasing.” More emphasis is placed on the change in the title of the study from “Oil Shale and Tar Sands Resources *Leasing*” to “Oil Shale and Tar Sands Resources *Management Plan Amendments to Address Land Use Allocations*.”

The reader can place whatever emphasis he or she wishes upon these distinctions. A "programmatic" EIS is simply one meant to be implemented.

The emphasis I will give over the next few articles will be the long but spotty history of the oil shale industry in Colorado, and the prospects of escaping from this history and creating a prosperous and minimally destructive industry comparable in size and influence to that of Saudi Arabia, but with groundwater.

Unpolluted groundwater.

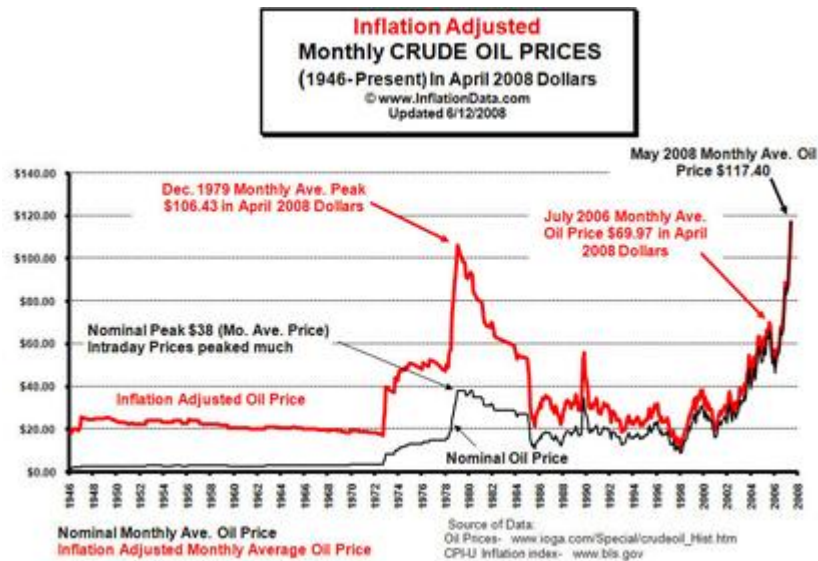
## Saudi Arabia or Chernobyl? Part Two

Glenn Walsh | 10/3/08

“Oil shale is the fuel of the future, and always will be” is the ironic but not comic joke heard on the Western Slope about the 800 billion barrels of oil 500 feet below the surface of the Roan Plateau.

For one hundred years, the oil shale below the surface has presented the possibility of a one hundred year oil supply.

The price of developing oil shale has been a carrot on a long stick for fifty years. Always twice the market price of better, more easily obtainable fuels. Only during two relatively recent surges in oil prices, both following Middle Eastern wars (one fought between Iran and Iraq, the other fought in downtown Manhattan and by Iran in Iraq), has that stick shortened. Continued...



It is not difficult to spot the two periods when debate about the production of shale oil has heated up.

Shale oil is a half-baked fuel, according to critics of experimental programs aimed at tapping those potential 800 billion barrels of reasonably high quality shale oil.

And supporters of the potential fuel — kerogen — admit that kerogen is a half-baked fuel. It has taken only one of the two steps on the way from dinosaur to the Sinclair station.

The question is: does half-baked make kerogen a cup half-full or half-empty?

Kerogen could have been oil, had it been deposited at 5000 rather than 500 feet and subjected to temperatures of 200 rather than 80 degrees.

So the thinking is kerogen can be oil if one subjects it to pressure — fractures it — and heats it to 1000 degrees at the surface. Remove what is valuable — the oil — and discard the rest.

However, discarding what's left is no longer an acceptable practice, after 10,000 years of serving humans well during economic and cultural evolution.

The technological challenge is two-fold: to economically separate the oil from the shale (marlstone actually), refine it to a practical fuel, and not destroy the critical environment where shale oil is located — the Colorado River basin.

Now, the history of any technology is for the most part a history of the accumulation of partial successes. And accumulating partial successes is not easy — take the aviation industry for example. But, at some point the aviation industry took off from fun old-timey films of multiwinged flapperdoodles falling off cliffs to the Bell X-1.

Critics should be clear. Are you criticizing a project because it can't work. Or because you deeply hope it won't work? Would the striking discovery of a Saudi-like oil supply in Lebanon — Lebanon, Kansas (the geographic center of the US) — 100 years of oil at \$2 per barrel production costs — be good news for you? Or would it doom your cherished hopes of fueling your car (or cars) with wind power? And do you have any cherished hopes for an energy future which do not involve powering (in an environmentally responsible way) an ever increasing array of sleek well-engineered contraptions?

Supporters of oil shale experimentation should be clear: No large scale commercially viable method of extracting oil from shale has yet been discovered, even back when discarding toxic gunk was an acceptable practice for an EPA which didn't exist.

Reasonably large oil shale projects in Sweden and Estonia have operated for decades, producing electricity and industrial oils and solvents. However, the marine oil shale in northern Europe exists in thin shale layers close to surface, the same formula for environmental disaster as exists in Wyoming. Scooping up poor marine coal and burning it is not a template for a shale oil industry in America which hopes to supply one-quarter of US petroleum demand in forty years.

An experimental shale oil project in Queensland, Australia produced 400,000 barrels per year between 2000 and 2004. Expansion of this demonstration project to stages 2 and 3 — with a projected output of 200,000 barrels per day — has been suspended, owing to cost overruns and environmental protests. Shaking and baking oil shale on the surface is an almost unavoidably filthy process. In fact, two months ago the Australian government imposed a 20-year moratorium on oil shale mining.

Recoverable high quality oil shales in Estonia and Australia, however, are about 1% of US reserves, so investment opportunities for further development have always been small.

Yet, even in the United States, with over two-thirds of high-yield oil shale, production has never topped 4,000 barrels per day by any producer using the mining and surface baking method. Surface retorting is the term used for traditional room-and-pillar mining or strip mining of shale followed by surface fracturing and baking. An industry attempting to produce millions of barrels of oil per day with this method — which has not improved for twenty years — might resemble the production of Uruk-hai in the bowels of Isengard.

To be fair, oil shale development has not until recently been aimed at large scale market production. Early last century, three oil shale reserves were set aside on federal lands located 8 miles west of Rifle, Colorado, in Garfield County. Development projects have focused on creating a backup, inland supply of oil for the military during tight wartime supply periods.

Had the outcome of the battles of Midway, Guadalcanal, Britain and Moscow been different, with the Imperial Navy blockading Western ports and the Wehrmacht throwing tanks not lost at Kursk across the Red River, a supply of diesel and jet fuel (whatever its foul byproducts) might have been more than marginally useful. Preparedness always seems foolish when your luck holds out. Why search the well-mannered academic gentleman to see if he has a box cutter in his attaché?

Oil shale only becomes part of the nation's energy planning when the reliable supply of better fuels (and petroleum is a superb fuel) becomes a sticky question.

Only two times in the past fifty years, have the prospects for Western oil shale been taken seriously as a significant source of the nation's energy portfolio.

Following the 1980 oil embargo no longer modified by the adjective "Arab" and the loss of oil production from Iran (which should never be modified by the same adjective), the Carter administration and an overwhelmingly Democratic Congress (at that point a Republican House of Representatives was thought to demographically impossible) approved a 5-year \$19 billion program which aimed to produce 1 million barrels of oil per day within ten years.

Congress provided a \$3 per barrel production tax credit and guaranteed producers a price of nearly \$30 per barrel for shale oil.

After the 1980 spike in oil prices from \$12 to \$35 dollars per barrel, Exxon announced its \$5 billion Colony oil shale project for the Piceance Basin near Rifle, Colorado. Exxon's plans called for the development of 150 oil shale plants within 20 years. These plants would be fed by six strip mines, each 3.5 miles long and 1.75 miles wide and one-half mile deep. Seven hundred schools, and 75,000 units of worker housing were to be constructed. Water for the project — strip mining and surface baking of oil shale can require 8 barrels of water for each barrel of oil produced — was to be piped from the Missouri River at a diversion point in South Dakota.

Property values in Rifle increase nearly tenfold, and building permit fees jumped more than twentyfold in Garfield County.

Oil prices were falling, however, after reaching a peak in 1979 just as Exxon was finalizing plans for its oil shale colony.

On May 2, 1982, with oil prices in a sharp decline that would drop per barrel prices below \$10 (an almost 80% freefall from per barrel expectations when the project was okayed), Exxon closed the Colony Project. Two thousand workers were fired. The economic multiples became divisors.

Sixty percent losses in property values were recorded in one week. Hundreds of businesses closed within one year and foreclosures rather than property values increased tenfold.

On the surface, the oil shale business was buried. A great deal of poignant focus is thrown by critics of oil shale development on the economic suffering caused by the shut down. People gambled and lost. While the hopes, greed, successes and suffering in a small boomtown are always fascinating, oil shale development has much more to do with Sinclair Oil than Sinclair Lewis.

People gamble \$10 billion and lose more than \$5 billion on each Super Bowl, and no one calls for the game to be cancelled.

Most of the 2000 jobs which were lost when oil prices fell 400% had only existed for less than one year before the project was cancelled. One rarely hears the same concerns voiced for the 500 generational jobs lost when the lumber mills were closed down in Pagosa Springs during the same period. Certainly, many environmental critics did not seem to care. Old economy dinosaurs.

At least, the 2000 workers who had moved to these jobs could move on to others. Beginning in 1982, in no small part helped by the decline in oil prices, the US economy entered the longest, almost uninterrupted expansion in history.

And conventional oil prices, in constant dollars, remained cheap for the next twenty years. Until another Middle Eastern war was started in downtown Manhattan, upsetting a lot of conventional thinking about the reliance of the United States on Saudi-dominated world oil markets.

### **Saudi Arabia or Chernobyl? Part Three**

Glenn Walsh | 10/6/08

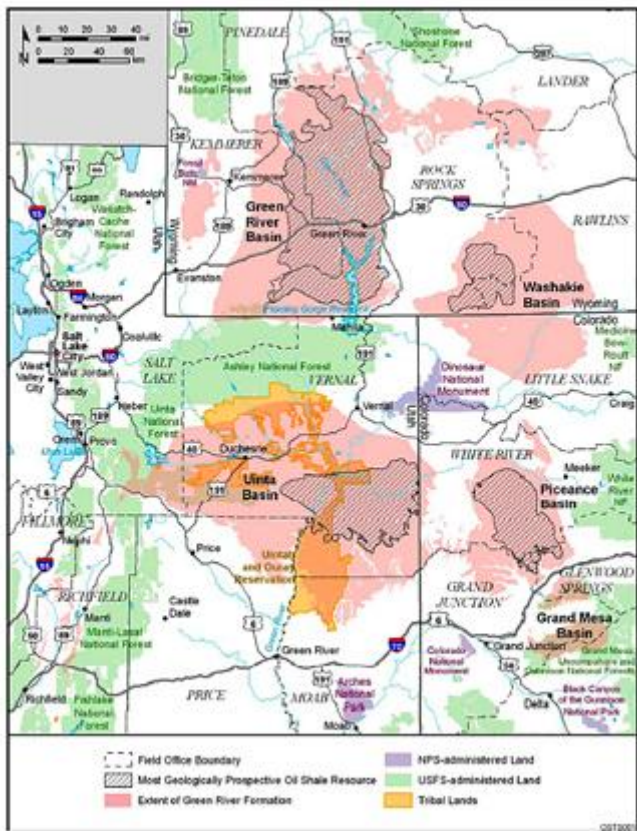
"To describe an industry still in its primary stage is not an easy task. Without definite commercial results to record, without well established processes to describe, and with information on all phases of the subject widely scattered and known only to the particular persons interested. ... The warning of geologists and government experts that the underground supply of oil cannot much longer be depended upon to supply the ever increasing demand, all unite in pointing unerringly to the one permanent supply of the raw material which we have — the deposits of oil shale. Whether we wish it to be so or not, we shall soon be forced to resort to the oil shales for our supply of oil. Regardless of the number and complexity of problems to be solved in establishing the oil

shale industry on a commercial basis, yet they must be solved, and it remains for the American mining engineer, chemist, and inventor to provide the solution."

The President of the Colorado School of Mines, looking at the prospects of the older petroleum industry for the rest of the century, issued this warning.

In 1920.

Then, as now, the Piceance Basin, within the triangle between Rifle, Meeker and Rangely, was known to possess the richest, thickest and largest oil shale deposits on the planet, over two-thirds of world's high quality supply, yielding up to 60 gallons of oil per ton. *Continued...*



Though small relative to other shale fields on this map and worldwide resource maps, the Piceance Basin northwest of Rifle is the richest in the world, containing reserves equivalent to 100 years of total US demand for oil.

Nearly a century after School of Mines President Victor Alderson issued this call for action, only 5 research, development and demonstration sites are at work within that Piceance triangle, aiming at maximum production of less than 5,000 barrels per day within the next few years (a barrel of oil equals 42 gallons).

Concentration of the oil shale in Colorado is greater than any other fuel source in the world, with some acres in the basin yielding a potential 2.5 million barrels of oil. This presents the opportunity to harvest the most concentrated source of Btu's on record from the smallest possible footprint. The closest second to this concentration -- a very distant second -- are coal seams which yield 20% of this barrel equivalent per surface acre in Wyoming.

Current US demand for oil is 20 million barrels per day. If the technological and ecological barriers to production of oil shale are overcome, the Piceance Basin might yield 5 million barrels per day within 40 years. Over 100 years of total present US demand could be supplied.

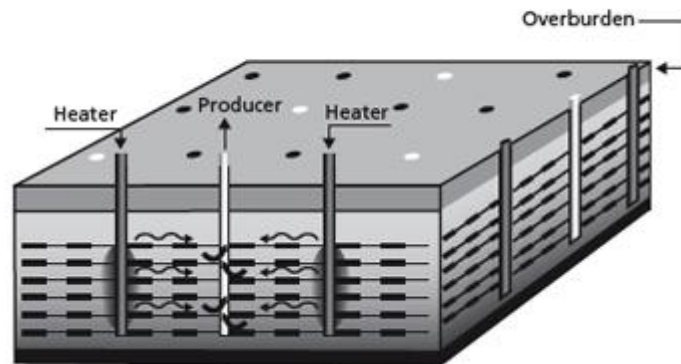
These millions of barrels per day will not be supplied by the decades old mine-and-bake process. There is no prospect for disposing of the toxic popcorn of cracked spent shale, swollen to 40% of its original volume, in an environmentally responsible way, no way to supply the eight barrels of water for each barrel of oil produced, or effectively deal with the toxic wastewater from the on-site refining of the heavy oil produced by surface retorting.

The first commercial surface retort plant capable of producing 50,000 barrels per day is forecast to cost \$5-7 billion, and a world oil price floor of \$70-95 per barrel is needed to make the above-ground process minimally profitable. The marginal cost of existing Saudi oil is \$2 per barrel; Texas oil, \$6 dollars per barrel. Much Russian oil, including exploration costs, can be brought to market for less than \$10.

### **Burying the oil shale industry?**

More accurately, can the shale be left in place and the oil harvested from depths that even the most destructive mining could not profitably access? If so, shale oil might be produced, refined and brought to market for less the \$30 dollars per barrel, which is less than half the current oil price floor forecast by many industry analysts. *Continued...*

**The Shell In-Situ Conversion Process**



Hundreds of thousand-foot holes per project will be heated by expensive coils, raising the temperature of shale formations to 600 degrees and millions of barrels of oil to the surface, if Shell's experiments prove practicable.

Royal Dutch Shell's Mahogany project has been exploring this possibility for more than a decade, gaining steam as oil prices approached and then surpassed \$100 per barrel. Shell's in-situ process involves drilling up to 25 holes per acre down through the shale formations, and using lengthy coils to heat the oil shale to a temperature of 600 degrees for years until a semirefined, light shale oil can be collected.

While Shell will only concede it has spent "tens of millions" on the project, industry analysts estimate that over \$200 million has been invested in the past five years. And Shell has not yet attempted to "scale up" its process to the 1,000 barrels per day level on its three 160-acre demonstration sites in the Piceance Basin.

That scale-up will be less the 1/200th the size of the planned in-situ processing sites, each planned to produce 200,000 barrels per day for up to 50 years. *Continued...*



**FIGURE A-8 Shell's Field Research in Rio Blanco County, Colorado (Courtesy: Shell Exploration & Production; reprinted with permission.)**

This experimental site is less than 1% the size of the in-situ processing projects intended for oil shale collection on the Roan Plateau.

The engineering challenges are as unprecedented as the potential return. Shell will need to prove that ammonia-based systems can create “freeze walls” two thousand feet deep to prevent groundwater movement into the oil collection zone, and oil and heated salts and industrial solvents from entering the surrounding groundwater.

Then Shell will need to show it can reduced the energy demands of heating the coils, increase the life of those coils (gold, silver and/or copper), and reduce the need for surface and ground water below the 1 barrel water/1 barrel oil threshold.

Whether oil shale can meet future demands for carbon reduction is another open question. But the industry has perhaps fifteen to twenty years after Al Gore recycles his private jet and reduces his \$2000 per month electric bill to address this problem.

And do all this while neither destroying the wildlife on the Roan Plateau or Shell's own financial health.

*Continued...*

Impact Category	Potential Magnitude of Impacts According to Species Type <sup>a</sup>						
	Amphibians and Reptiles	Shorebirds and Waterfowl	Land Birds	Raptors	Small Game and Nongame Mammals	Big Game Mammals	Wild Horses and Burros
Vegetation clearing	Large	Small	Large	Large	Large	Large	Large
Habitat fragmentation	Moderate	Small	Moderate	Moderate	Moderate	Moderate	Moderate
Blockage of movement and dispersal	Moderate	Small	Small	Small	Moderate	Moderate	Moderate
Alteration of topography and drainage patterns	Small	Small	Small	Small	Small	Small	Small
Water depletion	Large	Large	Moderate	Moderate	Moderate	Moderate	Moderate
Stream impoundment and changes in flow pattern	Large	Large	Large	Large	Large	Large	Large
Erosion and sedimentation	Small	Small	Small	Small	Small	Small	Small
Contaminant spills	Small	Small	Small	Small	Small	Small	Small
Fugitive dust	Small	Small	Small	Small	Small	Small	Small
Injury or mortality	Moderate	Moderate	Large	Moderate	Large	Large	Moderate
Collection	Large	Large	Small	Small	Small	Small	Small
Human disturbance/harassment	Small	Moderate	Large	Large	Large	Large	Large
Increased predation rates	Moderate	Moderate	Moderate	Small	Moderate	Moderate	Small
Noise	Small	Large	Large	Large	Large	Large	Large
Spread of invasive plant species	Small	Small	Moderate	Small	Moderate	Small	Small
Air pollution	Small	Small	Small	Small	Small	Small	Small
Fire	Small	Small	Moderate	Small	Moderate	Small	Small

The impacts on wildlife, while they threaten no extinctions, are not small, especially for big game mammals.

The negotiations between Shell and the Federal government for the leases on the Roan Plateau could be complex (or a giveaway). It is clearly a win/win situation for the Federal government if oil companies sink billions into oil shale research, seek no subsidies or royalty discounts, and disclose technical progress with perfect transparency to all potential bidders who have yet to invest in research and development. The poker game is easier when the guy with all the chips on the table holds his hand inside out.

If the world floor stays high, a large — potentially very large — domestic oil industry produces high grade oil, and profits, and jobs for half the world market price. Or the world floor falls back to \$20 barrel, and the US economy keeps \$1.2 billion per day on its side of the balance of payments fulcrum.

Of course, for Shell there is a potential lose/lose if the world price falls through the projected floor, and their investments in oil shales becomes a loss. A loss that is hard to recoup when their proven reserves (already shrinking) lose more than half their value.

### **Chernobyl?**

First, there is the metaphorical Chernobyl already mentioned: The devastation of western Colorado if half-mile deep strip mining and surface retorting of 5 million barrels of oil per day is attempted in the heart of the Colorado River Basin.

Second, is the Chernobyl that didn't happen in the Piceance Basin — ground zero of the potential oil shale breakthrough. A decade before the Russian nuclear accident there was an intentional American nuclear program called The Plowshare Program.

The Plowshare Program was a series of nuclear experiments the Atomic Energy Commission conducted to explore "peaceful uses" of nuclear explosives. North of Rifle in 1973, a peaceful experiment was attempted. Three nuclear bombs were detonated one atop the other to see whether the collective nuclear blast could rubble the sandstone and oil shale to permit the free flow of the nation's largest natural gas formation through the world's largest oil shale formation — and whether large underground nuclear fires might retort oil shale for easy collection.

Critics of federal inaction and obstruction of oil shale development are making good points, but they rarely note that one-quarter of valuable oil shale lands are held privately and have always been open to development. Or that the Federal government has not only subsidized oil shale development with billions of subsidies, but has also exercised the nuclear option in the shale fields.

The intelligent and careful long-term development of oil shale on the Roan Plateau requires, first of all, that we pull our heads out of the sand about a few things.