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California Energy Commission
Rod Jones, Project Manager
Systems Assessment & Facility Siting Division
James D. Boyd, Commissioner, Presiding Member
Jeffrey Byron, Commissioner, Associate Member
Raoul Renaud, Hearing Officer
1516 Ninth Street, MS-15
Sacramento, CA 95814
Phone: 916-654-5191
RJones@energy.state.ca.us < RJones@energy.state.ca.us>

Hydrogen Energy California (HECA) Permanency and Impact on Bacteria

Dear Sirs;

I am most concerned about the claim that the HECA process will result in the permanent storage of CO2 in the ground of the Elk Hills oil field. Nothing is permanent. I find this claim impossible to believe.

The following statements about the permanence of the CO2 storage in Elk Hills were made with absolute surety by HECA spokespersons:

George Minter, said, "CO2 permanent sequestration in Elk Hills is not a question – there is 40 years of history."

Michael Cox, Hydrogen Energy California, said, "[Elk Hills is] the most secure container in the world" "an impervious barrier" and "it is a stable container for liquids and gasses" and "the phase trapping, capillary action, and mineralization in the container can hold it there in perpetuity."

HECA provides a close-up perspective of the geologic structure in the Elk Hills area as justification for the claims of stability and permanence of the proposed project plan.

HECA should provided the wide-angle, long distance, long-term view of the forces acting on the Earth and project area as well as any calculations that show HECA considered the long-term cumulative impact effects of all the forces on which their conclusions were based.

The long-term view should include presentations by independent scientists and professors who speak to the issues of the geologic structure as well as all the cyclical and random extraterrestrial forces acting on the area from planetary influences and gravitational effects by Jupiter and the Sun and Moon in their various arrangements and orientations around the Earth (fluctuations caused from apogee to perigee and from solar to lunar eclipse positions and their permutations), as well as meteorites and asteroids (in particular the catastrophic, large bolides (asteroids) impacts on the Earth) and their effects on plate tectonics, continental drift, magma flows, rift zone pressures, and uplifts, folding, and faulting plates, earthquakes, and tidal effects, and on the

Earth's magnetic field. All of these forces and effects must be cumulatively analyzed to reach any conclusion on the relative stability or instability of the Elk Hills area.

Many examples of the relative instability, over time, on the Earth, are clear. Based on their similar magnetic properties, some geologists have concluded that West Africa and eastern South America have matching geologic structures that drifted apart. Whether the separation of those continental structures occurred rapidly or slowly is not a question. But those structures over time separated and no force prevented that separation.

The Himalaya Mountains were caused by the lateral movement of the floating crust with buckling at the collision edge of the India and the Asia plates.

Likewise, if some geologic force is applied to the disassociation of the continent at the point where the purported "impervious" rock domes of Elk Hills are located, they will disassociate in time, eventually releasing their stored CO2.

Not only are geologic forces in effect which could cause the disassociation of the Elk Hills area, but there are large astronomical forces in effect. The Earth and the moon are in a shooting gallery of sorts with asteroids as large as a mile in diameter taking aim.

There are thirty thousand asteroids of significant size for which the Earth is a target. Throughout history, meteorites have had more than close encounters with the Earth and the Moon as the scars on both will testify. There is evidence of impacts with the Moon and Earth by larger asteroids (bolides).

The Earth's thin crust is about 0.26 percent of the radius of the Earth. "Chunks of crust bob like so many corks on the surface of the viscose mantle, smashing into each other at various rates." [1]

Nels Winkless III and Iben Browning confirm the instability and impermanence of the Earth and its crust in their book *Climate and the affairs of Man.*

> Tidal forces cause changes in ocean levels of up to 50 feet in a day. Planetary forces are cyclical and can be additive or subtractive depending on where they are in the cycles. The cumulative effects of the planetary changes distort the diameter of the earth
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> Meteorite hits come to mind as the other likely source of round structures, and Barringer Crater near Winslow, Arizona, is the famous example. We began to search for other documented meteorite craters and turned up a number of them, such as Lake Bosumtwi in West Africa and Chubb Crater in Canada.
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> One begins to wonder after a while why the Moon is so chewed up with meteorite (or, preferably, *bolide)* strikes and the Earth is not. In fact, Earth *is* scarred by such strikes, but our atmosphere protects the surface by burning up the smaller incoming objects. Only the big ones make it to the surface and the craters that they have created tend to be

[1] (Nels Winkless III and Iben Browning, Climate and the affairs of Man, Harper and Row 1975)

masked by erosion and vegetation. The biggest ones are so big that they are difficult to detect from the ground.

The Rieskessel crater in Germany has a floor roughly fourteen miles in diameter surrounded by a thirteen-hundred-foot wall. The crater is very old, weathered, and overgrown, but it is visible under the overlying roads and human structures. During the 1940s the crater became visible to people who had occasion to fly over it in B-29s while on other business. Sixteen-inch chunks of material from this crater have been found forty kilometers away from the site. Something exciting obviously occurred there at one time and the conviction is growing that the event involved the fall of a big, heavy thing onto the Earth.

Rieskessel is but one of an increasing number of such structures identified on the Earth.

Let us recall the thirty thousand asteroids of significant size for which the Earth is a moving target. This notion of the celestial shooting gallery is dramatized by a passage from Baldwin's *The Face of the Moon:*

> "At first, the meteorite would plunge into the Earth moving faster than the shock waves and pushing ahead of it an ever increasing plug of compressed rock and probably a similar plug of compressed air. When the speed of the meteorite becomes less than that of the elastic waves, the vast amount of compression produced finds a shoulder against which to push, and the mass is soon stopped. With the stoppage of motion the meteorite is sitting on top of a tremendously compressed, tremendously hot plug of matter. Naturally, an explosion of the utmost violence follows." [2]

Violent, indeed!
A one-mile-diameter asteroid, Hermes, shot past the Earth on October 28, 1937, missing us by only seventy-five Earth diameters (600,000 miles) and passing through the Earth's orbit. This space-borne mountain would have blown out over 4,000 cubic miles from a crater 80 miles across and perhaps 25 miles deep. If it had hit an ocean, it would have made a tidal wave four miles high and it would have evaporated 3,800 cubic miles of water—enough for a 1.25-inch rain over the entire Earth.

Hitting at a skewed angle, its colossal earthquake-like waves would have vibrated the Earth like a gong. The P-waves (pressure waves) would have spread out like earthquake waves, while the S-waves (shear waves) would have been absorbed by the liquid core. The turbulence would have set up a fluid flow in the core of more than a hundred miles an hour and this enormous rotating iron armature would have altered the Earth's magnetic field.

A fireball would have blossomed from thirty to fifty miles high; and there, meeting no more atmospheric resistance, it would have thrust laterally, creating a fire funnel perhaps a hundred miles in diameter at its top. A part of the 4,000 cubic miles of crustal materials blown out would have been thrust laterally to spew out and reenter the atmosphere up to a thousand miles away as tektites. A part would have been reduced to dust and put into

[2] (Ralph B. Baldwin, ***The Face of the Moon,*** Chicago: University of Chicago Press, 1949)

orbit, cutting off half or more of the Earth's sunlight for years. A part would have been shot into space and would have constituted showers of stony meteorites for millennia to come. [3]

Watson calculates that the ". . . Earth probably goes at least 100,000 years between collisions with them . . . [4] (asteroids).[5]

"There is a 1-in-10,000 chance that a large (~2-km diameter) asteroid or comet will collide with the Earth during the next century, disrupting the ecosphere and killing a large fraction of the world's population. Although impacts of this magnitude are so infrequent as to be beyond our personal experience, the long-term statistical hazard is comparable to that of many other, more familiar natural disasters, raising the question of whether mitigation measures should be considered." [6]

"One of the most significant discoveries of the Space Age, the ubiquitous cratering of planetary surfaces by remnant debris from the origin of the planets, encourages a re- examination of the geological evolution of the Earth's surface. The bombardment by comets and asteroids is not complete and large, K/T-Boundary-scale impacts may be expected in the future. Impacts on Earth by 1 - 2 km diameter objects happen on a time scale of several hundred thousand years and have a small, but non-zero probability of creating a global ecological catastrophe within our lifetimes. The recent crash of fragments of tidally disrupted Comet Shoemaker-Levy 9 into Jupiter has dramatized the serious atmospheric consequences of impacts of comparatively small cosmic objects." [7]

The Earth's geological history exhibits many examples of geologic changes, some of them catastrophic and tumultuous, where nothing stayed the same. I find the permanence claim infeasible and illogical in the long term.

The benefits do not outweigh the possible, catastrophic costs. We already have too many problems, which are not being resolved, to create another.

Also, how would the HECA process impact the micro-organisms/bacteria that are living in the ground and the bacteria living in crude oil that are known to digest crude oil? How will the increase in ground-born CO2 impact these bacteria?

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[3] (Nels Winkless III and Iben Browning, *Climate and the affairs of Man*, Harper and Row 1975)
[4] (F. G. Watson, *Between the Planets*. New York Doubleday, 1962)
[5] (Nels Winkless III and Iben Browning, *Climate and the affairs of Man*, Harper and Row 1975)
[6] (*Nature* 367, 33 - 40 (06 January 1994); doi:10.1038/367033a0
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Planetary Science Institute, Science Applications International Corporation, 620 N. 6th Avenue, Tucson, Arizona 85705, USA. Space Science Division, NASA Ames Research Center, Moffett Field, California 94035, USA.)
[7] THE RISK TO CIVILIZATION FROM EXTRATERRESTRIAL OBJECTS and Implications of the Shoemaker-Levy 9 Comet Crash, Clark R. Chapman
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Respectfully submitted,

Mr. Ara Marderosian
P.O. Box 988
Weldon, CA 93283
(760) 378-4574
ara@sequoiaforestkeeper.org