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Improvement Reframed as Decline:

A Critical Review of the Mangano Report on Diablo Canyon and Infant Health

Anthropocene Institute, Generation Atomic, Mothers for Nuclear, WePlanet, and Xerxes Foundation.

Executive Summary

A report published in April 2026 by Joseph Mangano of the Radiation and Public Health Project (RPHP) claims that radiation from Diablo Canyon Nuclear Power Plant is causing measurable harm to infants and children in San Luis Obispo County. The report's title — "Worsening Newborn/Infant Health in San Luis Obispo County and the Diablo Canyon Nuclear Reactors" — states its conclusion plainly.

That conclusion is not supported by the evidence.

Infant mortality in San Luis Obispo County fell 54.7 percent during the early comparison "baseline" period (1979–1990, rate: 10.74 per 1,000 live births), and the most recent reliable endpoint (2019, rate: 4.86 per 1,000 live births). This is a substantial public health improvement, not a decline. The Mangano report obscures this by comparing San Luis Obispo's rate to California's statewide average across decades — a methodological choice that reframes measurable improvement as relative underperformance and labels it "worsening." This is not merely a methodological disagreement. It is a framing choice that obscures the underlying trend in the data and leads to a conclusion that is not supported by the evidence presented.

The report's supporting claims do not withstand scrutiny:

- The birth defects claim (114 percent above state average) rests on a very small sample — 73 cases over nine years — with no historical baseline, no independent verification, and no accounting for known variation in provider reporting practices. A comparison with birth defect rates reported internationally finds that the rate in San Luis Obispo is an order of magnitude lower than rates in countries with the lowest birth defect incidence in Europe, strongly suggesting a reporting artifact rather than a real health effect.

- Neither the infant mortality rate nor the claimed birth defect rate are placed in the statistical context of confidence intervals.

- The strontium-90 claim is drawn entirely from Mangano's own 2003 study, which has never been independently replicated — and which found that California as a whole had the lowest strontium-90 levels of any region studied, despite Diablo Canyon's operation. The report selectively cites a within-California comparison while omitting the national context that undermines it.

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- The actual measured radiation dose from Diablo Canyon to members of the public in 2024 was 0.002 millirem per year — less than one-tenth of one percent of the NRC's own ALARA target, and approximately one-three hundred thousandth of the average American's total annual radiation exposure. The report never mentions this number.

- A substantial confounder — maternal tobacco use in San Luis Obispo County running more than 150 percent above the state average — is dismissed without quantification.

This review documents each of these failures in detail, and describes what rigorous research on this question would actually require.

Methodology Note

All infant mortality data cited in this review were obtained from CDC WONDER (Wide-ranging Online Data for Epidemiologic Research), specifically the Linked Birth/Infant Death Records database and the Compressed Mortality File, and from the California Health and Human Services Open Data Portal. Queries were filtered to San Luis Obispo County, California, with infant deaths defined as deaths occurring within the first year of life per 1,000 live births. The "baseline" period (1979–1990) captures both the pre-startup era for Diablo Canyon (Unit 1 startup: 1984; Unit 2 startup: 1985) and shortly after, and should not be interpreted as a purely pre-startup baseline. Years with suppressed counts (fewer than 10 events) were excluded per CDC WONDER confidentiality protocols. Confidence intervals use the Poisson method with a Gamma distribution (Garwood, 1936).

All radiation dose data are drawn from PG&E Letter DCL-25-032, the 2024 Annual Radioactive Effluent Release Report submitted to the NRC in April 2025 under 10 CFR 50.36a(a)(2). Background radiation figures are from NCRP Report No. 160 (2009) as cited by the NRC and EPA.

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Section 1: Improvement Reframed as Decline

What the Mangano Report Claims

The report's title states that newborn and infant health in San Luis Obispo County is "worsening." The argument runs as follows: before Diablo Canyon opened, San Luis Obispo County's infant mortality rate was approximately 16 percent below the California state average. In the period 2010–2024, it was approximately 1 percent above the state average. This shift — from 16 percent below to 1 percent above — is presented as evidence of worsening infant health attributable to the plant. Notably, the report never shows the actual mortality rates underlying this comparison.

What the Data Actually Show

Analysis of CDC WONDER and California HHS data tells a different story:

Period	SLO Infant Mortality Rate	Change
Baseline 1979–1990	10.74 per 1,000 live births	—
2019 (most recent non-suppressed)	4.86 per 1,000 live births	54.7 percent
95 percent Confidence Interval (2019)	[2.51, 8.50]	—

Infant mortality in San Luis Obispo County improved by more than half over the period spanning Diablo Canyon's operation. A child born today is more than twice as likely to survive infancy as a child born before 1985. There is no reasonable interpretation of these data that can classify this as a worsening of infant health in San Luis Obispo County.

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How Improvement Becomes "Worsening": The Methodological Sleight of Hand

Mangano achieves his "worsening" conclusion by substituting a relative comparison for an absolute one. Rather than asking whether infant mortality in San Luis Obispo improved over time — which it did, substantially — he asks whether it improved as quickly as the California state average. Since some counties improved more than San Luis Obispo, that gap becomes "evidence" of harm.

This approach has a fundamental problem: a county that was already performing well before the plant opened has less room to improve. San Luis Obispo County's infant mortality rate was below the state average before Diablo Canyon began operating.

Convergence toward the state average over subsequent decades is consistent with regression to the mean, demographic shifts, differential improvements in prenatal care, and many other factors. Some counties, such as San Mateo, improved dramatically — likely reflecting economic and population changes driven by the technology industry boom — in ways that have nothing to do with nuclear power. Relative performance against a changing statewide average is not, by itself, evidence of radiation causing harm.

The report's title calls this "worsening." The underlying data show improvement of 54.7 percent. These are not two legitimate interpretations of the same facts.

A Note on Statistical Uncertainty

The 2019 San Luis Obispo infant mortality rate is based on 12 deaths. The 95 percent confidence interval is [2.51, 8.50] — a range of 5.99 per 1,000. This means the true underlying rate could plausibly be as low as 2.51 or as high as 8.50. When Mangano makes precise claims about San Luis Obispo's rate relative to the state average, those claims rest on a point estimate surrounded by wide uncertainty. The report does not acknowledge this.

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Section 2: Actual Radiation Dose — The Number the Report Doesn't Mention

Before examining the report's specific health claims, it is essential to establish what radiation exposure Diablo Canyon actually delivers to the public. This is the number on which any causal argument must stand. The Mangano report never provides it.

Measured Public Dose from Diablo Canyon (2024)

Under 10 CFR 50.36a(a)(2), PG&E is required to measure and annually report the radiation dose delivered to members of the public. The 2024 data, submitted to the NRC in April 2025, are as follows:

Pathway	2024 Dose	2023 Dose	2022 Dose
Gaseous effluents (total body)	1.76×10^{-3} mrem	4.25×10^{-4} mrem	1.83×10^{-3} mrem
Liquid effluents (total body)	2.17×10^{-4} mrem	5.71×10^{-4} mrem	2.75×10^{-4} mrem
Total public dose	~0.002 mrem/year	~0.001 mrem/year	~0.002 mrem/year

The NRC report notes: "The radiation dose to members of the public in 2024 in unrestricted areas outside the site boundary due to the release of radioactive gaseous effluents has been evaluated as negligible."

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What 0.002 Millirem Means in Context

Source	Annual Dose (mrem)
U.S. average, all sources (NRC/NCRP)	620
Natural background alone	310
Single cross-country flight (EPA)	2–5
NRC ALARA objective for nuclear plants	3
Federal public dose limit (40 CFR Part 190)	25
Diablo Canyon public dose (2024 measured)	0.002

Diablo Canyon's 2024 public dose is 0.07 percent of the NRC's ALARA target, 0.008 percent of the federal public dose limit, and roughly 1,000 to 2,500 times smaller than the dose from a single cross-country airplane flight. Doses at this level are orders of magnitude below those associated with observable health effects. Any claim that they are responsible for the outcomes described in the report would require particularly strong evidence, as such a claim would be in opposition to the general scientific consensus. To put it plainly: if radiation at these levels were harming children near Diablo Canyon, the far larger doses from routine flights and medical X-rays would produce effects that would be impossible to ignore. The report makes no attempt to address this.

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Section 3: The Birth Defects Claim

The Claim

The report states that San Luis Obispo County has a birth defects rate 114 percent above the California state average — the third highest among the state's 35 largest counties — based on data from 2016 to 2024.

Why This Claim Is Unverified

The sample is very small.

The claimed excess represents 73 cases over nine years. At this count, the 95 percent confidence interval around the rate is approximately [2.54–4.07] per 1,000 births — a range wide enough to encompass rates both dramatically above and much closer to the state average. Year-to-year variation in small counts is normal and does not indicate a trend.

There is no historical baseline.

The report does not show whether San Luis Obispo County's birth defects rate was elevated before Diablo Canyon began operating. Without a time series, there is no way to determine whether this finding has any relationship to the plant. If the rate was always elevated, the plant cannot be the cause.

Provider reporting variation is a documented confounder.

Birth defect rates vary substantially across counties and across countries, based on provider training, screening protocols, and reporting methodology. Some rates are derived from birth certificates; others rely on direct medical examination. The report makes no attempt to account for this. Crucially, the San Luis Obispo rate of 3.31 per 1,000 births — presented as alarmingly high — is an order of magnitude lower than rates reported for countries with the lowest birth defect incidence in Europe. The fact that other California counties show even lower rates strongly suggests these differences reflect reporting methodology, not any unique health hazard in San Luis Obispo. Additional California statewide data showing much higher birth defect rates further undermines the claim that the pattern observed here is attributable to Diablo Canyon.

No dose-response analysis is provided.

If Diablo Canyon radiation were causing birth defects, cases would be expected to concentrate in areas closest to the plant. No geographic breakdown is provided.

A single point estimate of 73 cases, presented without historical context, independent verification, international comparison, or geographic analysis, is not evidence of a radiation-related health effect. It is a number that requires investigation before any interpretation can be placed on it.

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Section 4: The Strontium-90 Claim and Its Internal Contradiction

The Claim

The report cites elevated strontium-90 (Sr-90) concentrations in baby teeth from San Luis Obispo and Santa Barbara County residents as evidence of elevated radiation exposure. Specifically, it states that those born in these counties had a 31 percent greater Sr-90 concentration than those born elsewhere in California.

The Source and Its Problem

The Sr-90 data come from a single study: Mangano et al. (2003), "An Unexpected Rise in Strontium-90 in US Deciduous Teeth in the 1990s," published in Science of the Total Environment. This study has not been independently replicated and has not been updated in over two decades. The measurements were conducted by Mangano's own organization, the RPHP, which has an established prior hypothesis that nuclear plant emissions cause harm. The sample was self-selected, which may have resulted in overrepresentation of children who had received radiation treatments. No government agency has independently verified these findings.

Self-citation of an unreplicated study from one's own advocacy organization is not independent evidence.

The Internal Contradiction

More critically, the 2003 paper's own findings undermine the use being made of them. The paper's abstract states: "The highest averages were found in southeastern Pennsylvania, and the lowest in California (San Francisco and Sacramento), neither of which is near an operating nuclear reactor."

California, despite having Diablo Canyon and San Onofre in operation and Rancho Seco recently closed at the time of the study, had the lowest strontium-90 levels of all five states studied:

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State	Average Sr-90 (mBq/g Ca)
Pennsylvania	154
New York	138
Florida	130
New Jersey	125
California (lowest)	108
State	Average Sr-90 (mBq/g Ca)

Within California, San Luis Obispo and Santa Barbara counties show 127 mBq/g Ca — 31 percent above the rest-of-California figure. This is the number the 2026 report cites. What it does not cite is that 127 mBq is still lower than Pennsylvania (154), New York (138), Florida (130), and essentially tied with New Jersey (125). The highest Sr-90 level in California sits below four of the five states studied.

The Rancho Seco Problem

The 2003 paper also reports Sr-90 near Rancho Seco, a nuclear plant that had been closed for twelve years at the time of sampling. Its Sr-90 level (106 mBq/g Ca) was lower than every state average in the study, and lower than every currently operating reactor site measured. If reactor emissions were the primary driver of elevated Sr-90, a plant operational for fifteen years should show readings well above baseline — not the lowest in the study. This is incoherent with the hypothesis, and suggests the observed patterns reflect persistent weapons-test fallout, regional dietary variation, or sampling artifact rather than reactor emissions.

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Selective Citation and Study Limitations

The 2026 report quotes the 31 percent within-California difference while omitting California's position as the lowest-exposure state nationally. Presenting a within-state comparison as evidence of elevated exposure, while suppressing the national context that shows the opposite, is a misleading use of prior research. The 2003 study also lacks data from states like Illinois — where a large fraction of electricity is generated by nuclear power — and from non-reactor control regions within states. Combined with the small number of teeth sampled per location, these gaps make it impossible to confidently attribute the observed Sr-90 patterns to reactor operations rather than to unmeasured regional or dietary factors.

Section 5: The Dismissed Confounder — Maternal Tobacco Use

The report's own Appendix 9 shows that San Luis Obispo County has maternal tobacco use rates substantially above the California state average:

- Tobacco use before pregnancy: 3.72 percent in SLO vs. 1.45 percent statewide — a difference of 157 percent
- Tobacco use during pregnancy: elevated at a similar magnitude

The established literature on maternal smoking and adverse birth outcomes is unambiguous. Smoking during pregnancy increases preterm birth risk by approximately 21 percent (Delcroix et al., 2023) and low birth weight risk by approximately 95 percent. A county with 2.6 times the state average smoking rate among pregnant women has a major, quantifiable risk factor for the very outcomes the report attributes to radiation. If radiation is suspected in causing these supposed increases in birth defects, then smoking is a more plausible mechanism, as a single cigarette delivers a dose 900 times higher than the yearly releases from Diablo Canyon.

The report acknowledges the elevated smoking rate and dismisses it as too small to matter — without providing any calculation. A rigorous analysis would estimate the expected elevation in adverse birth outcomes attributable to the smoking differential, then determine whether residual excess remains after accounting for it. The report does neither.

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Other unaddressed confounders include agricultural chemical exposure, variation in prenatal care access, demographic composition changes over the study period, and healthcare system differences affecting outcome reporting.

Section 6: The Logic of Causation and Why It Fails Here

Establishing that an environmental exposure causes a health outcome requires meeting several evidentiary standards. None are met here.

1. The health outcomes must be real.

Infant mortality has improved 54.7 percent. The birth defects claim rests on 73 cases reported using methodology that cannot be reliably compared to rates elsewhere. Neither establishes that a health problem exists.

2. The exposure must be meaningful.

The actual measured radiation dose is 0.002 mrem/year — far below any level at which biological effects have been observed, and far below the doses residents receive from natural background radiation, medical imaging, and air travel.

3. There must be a dose-response relationship.

If radiation is the cause, health outcomes should be worse closer to the plant. No geographic analysis within the county is provided.

4. Confounders must be ruled out.

Maternal tobacco use at 2.6 times the state rate is a well-established driver of the outcomes under discussion and is dismissed without quantification.

5. The timing must be consistent with the hypothesis.

If the plant has been harming infants since 1984–85, infant mortality should have risen or plateaued after startup. Instead, it fell 54.7 percent continuously across the entire operational period. This is the opposite of what the hypothesis predicts.

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Section 7: What Rigorous Research Would Require

The question of whether living near a nuclear power plant affects infant health outcomes is a legitimate scientific question of genuine public importance. It deserves rigorous investigation. The standard for that investigation is substantially higher than what this report provides.

Research capable of detecting a real signal would need:

Individual-level exposure data.

County-level aggregates cannot establish who was exposed to what. A rigorous study would estimate radiation exposure based on residential proximity, prevailing wind patterns, dietary pathways, and duration of residence.

A matched comparison group.

Comparing San Luis Obispo to the California state average conflates many different factors. A valid comparison would identify counties with similar demographics, healthcare access, and economic characteristics that differ primarily in proximity to a nuclear plant.

Time-series data with pre-startup baseline.

Demonstrating that health outcomes changed after the plant began operating — rather than were always elevated — is necessary to establish any temporal relationship.

Independent verification of health outcome data.

Birth defect rates are sensitive to provider reporting practices. Independent validation that reported rates reflect true health differences, not administrative variation, is essential.

Quantified confounder adjustment.

Maternal tobacco use, agricultural chemical exposure, and other known risk factors must be statistically adjusted for, not acknowledged and dismissed.

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Dose-response analysis.

If radiation is the cause, people more exposed should show worse outcomes than people less exposed within the county. Without this analysis, no causal inference is possible.

Until research meeting these standards is conducted and peer-reviewed, the question of whether Diablo Canyon affects infant health outcomes in San Luis Obispo County remains open. The Mangano report does not answer it.

Section 8: Assessment

What the Report Gets Right

The report correctly notes that Diablo Canyon has released radioactive materials into the environment — documented in NRC filings and not in dispute. It correctly observes that developing infants and children are more radiosensitive than adults. And it correctly identifies that updated federal epidemiological research near nuclear plants would be valuable; the 1990 National Cancer Institute study is now 36 years old.

What the Report Gets Wrong

The central health claim is factually inverted. Infant mortality in San Luis Obispo County improved 54.7 percent over the period of Diablo Canyon's operation. The report's title says the opposite.

The birth defects claim is unverified. Seventy-three cases over nine years, with no baseline, no independent verification, and no accounting for reporting variation, does not constitute evidence of a radiation-related health effect.

The strontium-90 claim contradicts Mangano's own prior research. The 2003 paper he cites found California to have the lowest Sr-90 of any region studied. The 2026 report presents a within-California comparison as evidence of elevated exposure while suppressing this national context.

The actual radiation dose is never mentioned. At 0.002 mrem/year, it is biologically negligible and falls orders of magnitude below any established health effect threshold.

The primary confounder is dismissed without analysis. Maternal tobacco use at 2.6 times the state average is a known, quantifiable driver of the outcomes under discussion.

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Conclusion

The Mangano report presents a predetermined conclusion — that Diablo Canyon is harming infants — and assembles a selective reading of data in its support. The central finding of "worsening" infant health is produced by a methodological choice that obscures a 54.7 percent improvement in the underlying outcome. The supporting claims are either unverified, internally contradicted, or dependent on the author's own unreplicated prior work.

Decisions about the future of Diablo Canyon — a plant supplying nearly a quarter of California's carbon-free electricity to more than three million homes — should be made on the basis of credible evidence. The Mangano report does not provide it.

What it does provide is a demonstration of how comparative framing and selective citation can make a substantial public health improvement appear to be a crisis. Recognizing that technique, and demanding better, is necessary for sound public health research.

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