An Independent Scientific Assessment of Well Stimulation in California

Volume III

Case Studies of Hydraulic Fracturing and Acid Stimulations in Select Regions: Offshore, Monterey Formation, Los Angeles Basin and San Joaquin Basin

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About CCST

CCST is a non-profit organization established in 1988 at the request of the California State Government and sponsored by the major public and private postsecondary institutions of California and affiliate federal laboratories in conjunction with leading private-sector firms. CCST's mission is to improve science and technology policy and application in California by proposing programs, conducting analyses, and recommending public policies and initiatives that will maintain California's technological leadership and a vigorous economy.

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Acronyms and Abbreviations

ALA	American Lung Association
APCHH	American Petrofina Central Core Hole
API	American Petroleum Institute
ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry
BAT	Best Available Treatment Economically Achievable
bbl	Oil Barrel
bble	Oil Barrel Equivalent Energy
BBO	Billion Barrels of Oil
BCT	Best Conventional Pollutant Control Technology
BLS	(U.S.) Bureau of Labor Statistics
BOE	Barrels of Oil Equivalent
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
CARB	California Air Resources Board
CCC	California Coastal Commission
CCST	California Council on Science and Technology
CDC	Centers for Disease Control and Prevention
CER	Categorical Exclusion Reviews
CI	Confidence Interval
CI	Carbon Intensity
CMIT	Biocide 5-Chloro-2-methyl-3(2H)-isothiazolone
CSLC	California State Land Commission
CT	Cristobalite and Tridymite
CVRWQCB	Central Valley Regional Water Quality Control Board
DG	Distributed Petroleum-Powered Generation
DMR	Discharge Monitoring Report
DOE	U.S. Department of Energy
DOGGR	(California) Division of Oil, Gas, and Geothermal Resources
DPH	Department of Public Health
DWR	Department of Water Resources
EOR	Enhanced Oil Recovery
FM	Fractured Monterey
FOIA	Freedom of Information Act
FR	Federal Register
ft	Feet
GAMA	Groundwater Ambient Monitoring & Assessment
GHG	Greenhouse Gases
GHS	Globally Harmonized System

GIS	Geographic Information Systems
GOR	Gas-Oil Ratio
GSM	Gaviota-Sacate-Matilija
HAP	Hazardous Air Pollutant
HBACVs	Health-Based Air Concentration Values
HCl	Hydrochloric Acid
HF	Hydraulically Fractured
HLTHFAC	California Health Care Facility Dataset
HRGP	High-Rate Gravel Packs
ICIS/PCS	Integrated Compliance Information System and Permit Compliance System (database)
iF	Intake Fraction
IRIS	Integrated Risk Information System
kg	Kilogram
L	Liter
LBNL	Lawrence Berkeley National Laboratory
m^3	Cubic Meter
m^3e	Cubic Meter of Oil Equivalent Energy
mi.	Mile
MMS	Minerals Management Service
MRLs	Minimal Risk Levels
NOAA	National Oceanic and Atmospheric Administration
NO_x	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
OCS	(Federal) Outer Continental Shelf
OEHHA	Office of Environmental Health Hazard Assessment
OOIP	Original Oil In Place
OR	Odds Ratio
OSHA	Occupational Safety and Health Administration
OSPAR	Oslo and Paris Convention
PAH	Polycyclic Aromatic Hydrocarbons
PLSS	Public Land Survey System
PM	Particulate Matter
PM_{10}	Particulates Smaller than 10 Microns
$PM_{2.5}$	Particulates Smaller than 2.5 Microns
PPB	Parts Per Billion
PPM	Parts Per Million
PR	Pico-Repetto
REL	Reference Exposure Levels
RfC	Reference Concentrations
RfDs	Reference Doses
RMT-SAV	Rincon-Monterey-Topanga-Sespe-Alegria-Vaqueros
RO	Reverse Osmosis
ROG	Reactive Organic Gases
SB 1281	Senate Bill 1281

SB 4	Senate Bill 4
SCAQMD	South Coast Air Quality Management District
SCEDC	Southern California Earthquake Data Center
SIC	Standard Industry Classification code
SJVAB	San Joaquin Valley Air Basin
SJVUAPCD	San Joaquin Valley Unified Air Pollution Control District
SoCAB	South Coast Air Basin
SO_x	Sulfur Oxides
SWRCB	(California) State Water Resources Control Board
TAC	Toxic Air Contaminant
TCW	Treatment, Completion, and Workover
TDS	Total Dissolved Solids
THUMS	Texaco, Humble, Union, Mobil, and Shell (a set of artificial islands)
TOC	Total Organic Carbon
TOG	Total Organic Gases
TR	Transformation Ratio
TRRC	Texas Railroad Commission
TVD	True Vertical Depth
U.S. EIA	U.S. Energy Information Administration
U.S. EPA	U.S. Environmental Protection Agency
UIC	Underground Injection Control
USC	United States Code
USDW	Underground Source of Drinking Water
USGS	United States Geological Survey
USQFF	U.S. Quaternary Fault and Fold Database
VCAPCD	Ventura County Air Pollution Control District
VOC	Volatile Organic Compound
WDR	Waste Discharge Requirements
WET	Whole Effluent Toxicity
$\mu g/m^3$	Micrograms per Cubic Meter