



Offsite Impact of the Santa Susana Field Laboratory

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PROLOGUE

Since my retirement in 2015, I have begun new pastimes and made many new friends. When they learn of my previous career, they frequently repeat the myths they have read or heard about Santa Susana in the media. I attempt to respond to these questions/concerns, either verbally, or by providing them with more detailed documented evidence. That is one of the reasons why I decided to write this paper and compile some of the voluminous environmental history of SSFL, at least those parts with which I was directly involved. The other major reason is that there exists no single online location that pulls together the history of environmental studies at SSFL. The DTSC SSFL website contains numerous documents, but its Document List is just that, a “list,” with no roadmap or chronological timeline to connect documents, cementing them together and summarizing their major objectives, findings, and conclusions.

Hopefully, this paper will answer your questions in a clear and understandable way and provide evidence to counter the misinformation surrounding Santa Susana.

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West Hills, California
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TABLE OF CONTENTS

PROLOGUE	2
TABLE OF CONTENTS.....	3
FIGURES.....	8
TABLES.....	9
ABBREVIATIONS	10
1.0 EXECUTIVE SUMMARY	19
1.1 Objectives	20
1.2 Organization	22
1.3 Disclaimer	24
1.4 Acknowledgements	25
1.5 How to Read this Report	25
2.0 SANTA SUSANA FIELD LABORATORY.....	26
2.1 Geographical Location.....	26
2.2 History	28
3.0 THE EARLY YEARS	29
3.1 Hot Lab SNM-21 License Renewal (1989-1990)	29
3.2 Reviews of Radiological Environmental Monitoring Programs (1989-1991).....	31
3.3 DOE Environmental Survey (1989)	33
3.4 Factual Perspective (1989 - 1991)	34
3.5 SSFL Work Group (1989 - 2020)	35
3.6 Past Accidents at SSFL (1980).....	36
4.0 SODIUM REACTOR EXPERIMENT	37
4.1 SRE Fuel Damage Accident (1959)	37
4.2 SRE Presentations.....	37
4.3 SRE Videos	40
4.4 SRE Accident Reports	43
4.5 SRE Meteorological Data (2007)	44
4.6 DOE SRE Workshop (August 2009).....	45
5.0 RADIOLOGICAL CHARACTERIZATION SURVEYS.....	47
5.1 DOE SSFL Site Radiological Survey (1987-1988).....	47



5.2 Area IV Radiological Characterization Survey (1994-1996)	48
5.3 EPA Area IV Radiological Study (2008-2012).....	50
5.4 EPA Radiological Background Study (2009-2011)	55
5.5 Comparison to McLaren-Hart Background Data	59
6.0 HISTORICAL SITE ASSESSMENTS OF AREA IV	60
6.1 Sapere HSA (2005).....	60
6.2 EPA HSA (2012).....	60
6.3 Radionuclides Related to Historical Operations at SSFL Area IV.....	63
7.0 ONSITE MEDIA SAMPLING	64
7.1 ETEC Annual Site Environmental Monitoring Reports (1955-2019)	64
7.2 ETEC NESHAPS Effluent Monitoring Reports (1992-2017).....	68
7.3 RCRA Facility Investigation - Soil	70
7.4 RCRA Facility Investigation - Groundwater	70
7.5 Stormwater.....	70
7.5.1 Interim Source Removal Action	71
7.6 Air Monitoring	72
8.0 OFFSITE MEDIA SAMPLING	75
8.1 Boeing and Third-Party Sampling Programs	75
8.2 Ahmanson Ranch (2000-2003)	78
8.3 American Jewish University (AJU) (2016-2022)	80
8.4 Bell Canyon (1998)	83
8.5 Brandeis-Bardin Institute and Santa Monica Mountains Conservancy (1991, 1992 and 1994).....	86
8.6 Chatsworth Nature Preserve/Reservoir (2004-2010)	89
8.7 Dayton Canyon (2005-2008)	92
8.8 Orcutt Ranch and Justice Street School (2006).....	98
8.9 Rocketdyne Recreation Center (1997)	99
8.10 Runkle Canyon (1999-2010)	100
8.11 Woolsey Canyon (2008)	106
8.12 Northern Drainage - Former Shooting Range (2007-Present)	108
8.13 North-East Groundwater.....	112
8.14 Offsite Data Evaluation Report (2007)	112
8.15 DTSC Offsite Investigations Overview (2018).....	114



9.0	WORKER HEALTH STUDIES.....	117
9.1	UCLA Rocketdyne Worker Health Study - Ionizing Radiation (1997).....	117
9.2	UCLA Rocketdyne Worker Health Study - Selected Chemicals (1999).....	123
9.3	IEI Follow-on Rocketdyne Worker Health Study (2005)	124
10.0	COMMUNITY HEALTH STUDIES.....	127
10.1	Department of Health Services	130
10.1.1	Department of Health Services (1990)	130
10.1.2	Department of Health Services (1992)	130
10.1.3	Commentary on the DHS Studies	133
10.2	Tri-Counties Regional Cancer Registry (1997).....	133
10.2.1	Commentary on the Nasser Study (1997)	134
10.3	Department of Toxic Substances Control (1999)	134
10.3.1	Rocketdyne Inquiry (1999)	134
10.3.2	DTSC Expert Panel Review (1999)	136
10.3.3	Commentary on the DTSC Inquiry (1999).....	136
10.4	Retinoblastoma (2005-2007)	136
10.4.1	USC Cancer Surveillance Program (2005).....	136
10.4.2	DHS Cancer Surveillance Center (2007).....	137
10.5	Public Health Institute (2006)	138
10.6	Morgenstern Community Cancer Study (2006-2007).....	138
10.6.1	Boeing Response to the Morgenstern Study (2007)	141
10.6.2	Warren Comments on the Morgenstern Study (2007)	141
10.6.3	Blot Critique of the Morgenstern Study (2007).....	142
10.7	Thomas Mack (2011-2014).....	143
10.8	Flawed Statistics	144
10.9	DTSC Summary of Community and Worker Health Studies.....	145
10.10	Dr. Weitzberg's Summary of Community and Worker Health Studies (2014)	145
10.11	Boeing's Message to Visitors to SSFL (2014).....	145
10.12	PowerPoint Review of ATSDR Sponsored Studies (2016)	145
11.0	COMMUNITY EXPOSURE STUDIES	146
11.1	ATSDR (1999).....	146
11.2	SSFL Advisory Panel (2006)	147



11.2.1 Boeing Response to Advisory Panel Report (2006)	148
11.2.2 Health Physics Society Response (2006)	149
11.2.3 Former Reviews of the SRE Accident (2005)	150
11.2.4 Union of Concerned Scientists Position on the SRE Accident	150
11.3 UCLA Cohen Exposure Assessment Study (2006)	151
11.3.1 Boeing Response to the Cohen Exposure Report (2006)	152
11.3.2 Warren Response to the Cohen Exposure Report (2006)	155
12.0 OFFSITE DISPOSAL OF DECOMMISSIONED MATERIAL	158
12.1 FSDF Soil Disposal (2000)	158
12.2 Donated Trailers (2000).....	160
12.3 Building Demolition and Waste Disposal (2000).....	162
12.4 Disposal of Decommissioned Material to Landfills (2002).....	162
12.4.1 California Integrated Waste Management Board (2002).....	162
12.4.2 Los Angeles City Council (2002).....	163
12.4.3 Los Angeles Sanitation District (2002).....	163
12.4.4 Waste Management and Clean Harbors (2002-2003)	163
12.4.5 Independent Sampling of California Landfills (2002-2003)	163
12.5 Disposal of Decommissioned Material to Landfills (2004-2006)	164
12.6 Proposal to Dispose of NASA Soil to a Class I Hazardous Waste Landfill (2009)	166
12.7 Demolition and Disposal of Remaining Boeing-owned Area IV Buildings (2012-2022).	166
12.8 Demolition and Disposal of Remaining DOE-owned Area IV Buildings (2020-2021).....	167
12.9 Decommissioning and Disposal of Decommissioned Material	167
13.0 WILDFIRES AT SSFL.....	168
13.1 Topanga Fire (2005)	168
13.2 Woolsey Fire (2018)	171
13.2.1 Department of Toxic Substances Control Report.....	171
13.2.2 Los Angeles Regional Water Quality Control Board	173
13.2.3 Boeing	173
13.2.4 DOE	173
13.2.5 Critique of Fairewinds Study.....	174
13.2.6 Risk Assessment Corporation	175
14.0 EPA SUPERFUND EVALUATIONS	179



14.1 Santa Susana Field Laboratory (1989).....	179
14.2 Former Sodium Disposal Facility (1989).....	179
14.3 Energy Technology Engineering Center (1993).....	180
14.4 Energy Technology Engineering Center - Area IV (2003).....	180
14.5 Santa Susana Field Laboratory (2007).....	181
14.6 Political Shenanigans (2007-2008).....	183
15.0 MISCELLANEOUS STAKEHOLDER OUTREACH	185
16.0 MEDIA	187
17.0 CARTOON HUMOR.....	188
18.0 STRAIGHT TALK	189
18.1 Thou Doth Protest Too Much, Methinks.....	189
18.2 Why Is Cleanup Taking So Long?.....	190
18.3 Epidemiology and Epidemiologists	191
18.3.1 Community Health Studies.....	191
18.3.2 Worker Health Studies.....	192
18.4 Politics and Politicians	192
18.4.1 Sheila Kuehl	193
18.4.2 Barbara Boxer	194
18.4.3 Other Politicians	194
18.6 Real Estate Disclosures.....	194
18.7 Anti-Nuclear Movement.....	195
18.8 Our Children	195
18.8.1 Teens Against Toxins	196
18.8.1 Melissa Bumstead.....	197
18.8.2 Ruth Luevanos	201
19.0 BEYOND A REASONABLE DOUBT	205
ABOUT THE AUTHOR.....	209



FIGURES

Figure 1. Location of SSFL in Relation to Local Communities	26
Figure 2. Santa Susana Field Laboratory Site Arrangement	27
Figure 3. Daily News Reporting 1989 DOE Environmental Survey	33
Figure 4. First Nuclear-Powered Commercial Electricity	42
Figure 5. Areas Exceeding Radiological Background (LUT Values)	53
Figure 6. Areas Exceeding Chemical Background (LUT Values)	54
Figure 7. Area IV - Where are the Radionuclide Contaminants?	55
Figure 8. Offsite Media Sampling Map (compiled in 2005)	76
Figure 9. Upper Las Virgenes Canyon Open Space Preserve	79
Figure 10. American Jewish University	81
Figure 11. Bell Canyon.....	84
Figure 12. Brandeis-Bardin Institute	86
Figure 13. Sage Ranch Looking Towards SSFL.....	87
Figure 14. Early View of Chatsworth Reservoir	90
Figure 15. Chatsworth Nature Preserve Today.....	90
Figure 16. Dayton Canyon.....	93
Figure 17. Rocketdyne Recreation Center (2013).....	99
Figure 18. Fallbrook Park Today.....	100
Figure 19. Runkle Ranch.....	101
Figure 20. Mountain View Village	107
Figure 21. DTSC Offsite Investigation Overview	115
Figure 22. DTSC Summary of Investigations of Surrounding Properties	116
Figure 23. Media Response to the UCLA Rocketdyne Worker Health Study.....	117
Figure 24. Media Humor about the SRE Accident	147
Figure 25. Topanga Fire Boundary	169
Figure 26. Infra-red Image of Topanga Fire	169
Figure 27. Area IV Buildings Escape Topanga Fire	170
Figure 28. Vegetation, Ash, and Air Sampling.....	170
Figure 29. Missing the Point	182
Figure 30. Political Attention from Kuehl and Boxer	193
Figure 31. Teens Against Toxins Donating \$99.31 Check to Boeing.....	196
Figure 32. Melissa Bumstead	200



TABLES

Table 1. SRE Compared to Three Mile Island, Unit 2	38
Table 2. SRE Core Behavior	39
Table 3. SRE Accident Compared to Other Nuclear Accidents	40
Table 4. Background Parameters for Cesium-127 and Strontium-90.....	58
Table 5. Comparison of McLaren-Hart and EPA Background	59
Table 6. Air Monitoring Annual Reports	73
Table 7. Offsite Media Sampling (compiled in 2005).....	77
Table 8. Offsite Media Sampling Organizations (compiled in 2005)	78
Table 9. Miscellaneous Stakeholder Outreach Briefings	185
Table 10. Evidence from Offsite Sampling	206
Table 11. Evidence from Community Health Studies	207
Table 12. Evidence from the Woolsey Fire	207
Table 13. Evidence from Offsite Disposal of Decommissioned Material	208
Table 14. Evidence from Worker Health Studies	208



ABBREVIATIONS

ABMA	(US) Army Ballistic Missile Agency
A/C	Air Conditioning
AE	Atomic Energy
AEA	Atomic Energy Act
AEC	(US) Atomic Energy Commission
AF	(US) Air Force
AFP	Air Force Plant
AI	Atomics International
AJU	American Jewish University
ANL	Argonne National Laboratory
AOC	Administrative Order on Consent (2010)
AOC	Amendment to Order on Consent (2020)
APA	(California) Administrative Procedures Act
AR	Aerojet Rocketdyne
ASER	Annual Site Environmental Report
asl	above sea level
ATSDR	Agency of Toxic Substances Disease Registry
A4CM-XX	ETEC document serial number
B.A.	Bachelor of Arts
BBC	Brandeis-Bardin Campus
BBI	Brandeis-Bardin Institute
BEIR	Biological Effects of Ionizing Radiation
BTV	Background Threshold Value
CAG	Community Advisory Group
CalEPA	California Environmental Protection Agency
CBG	Committee to Bridge the Gap
CC	Confidence Coefficient



CCR	California Cancer Registry
CD	Compact Disc
CDC	Center for Disease Control
CDC-NIOSH	CDC National Institute of Safety & Health
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CFR	Code of Federal Regulations
CHP	Certified Health Physicist
CI	Confidence Interval
CIH	Certified Industrial Hygienist
CL	Confidence Limit
CLL	Chronic Lymphocytic Leukemia
CLRRA	California Land Reuse & Revitalization Act
CGG	Computer Generated Graphics
cm	centimeter
COC	Contaminant of Concern
COC	Chain of Custody
COPC	Contaminant of Potential Concern
CRPE	Center for Race, Poverty, and the Environment
CSUN	California State University, Northridge
Cs-137	Cesium-137
CV	Curriculum Vitae
CW	Consumer Watchdog
DCGL	Derived Concentration Guideline Level
D&D	Decontamination and Decommissioning
D&D	Decommissioning and Demolition
DHHS	(US) Department of Health & Human Services
DHS	(California) Department of Health Services (Now DPH)



DOE	(US) Department of Energy
DOL	(US) Department of Labor
DPH	(California) Department of Public Health (Formally DHS)
DR	Dose Ratio
Dr.	Doctor
DRF	Document Reference File
DSFR	Data Summary and Findings Report
DTL	Distant Test Location
DTSC	(California) Department of Toxic Substances Control
DWP	(Los Angeles) Department of Water & Power
EEOICPA	Energy Employees Occupational Illness Compensation Program Act
EM	(DOE) Environmental Management
EMB	(CDPH) Environmental Management Branch
EO	(California) Executive Order
EPA	(US) Environmental Protection Agency
EPRI	Electric Power Research Institute
EQWM	Environmental Quality & Waste Management Committee of the Los Angeles City Council
ERDA	(US) Energy Research & Development Administration
ERG	Eastern Research Group
ESG	Energy Systems Group
ETEC	Energy Technology Engineering Center
FAL	Field Action Level
FAQ	Frequently Asked Question(s)
FOIA	(US) Freedom of Information Act
FRC	Federal Radiation Council
FRMAC	(DOE) Federal Radiological Monitoring and Assessment Center
FSDF	Former Sodium Disposal Facility
GB	Gigabytes (1,000,000,000 bytes)



GEN-ZR-XXX	ETEC Document Serial Number
GRC	Groundwater Resources Corporation
GSA	(US) General Services Administration
GSI	GSI Environmental Inc.
H&A	Hailey and Aldrich
H&S	Health and Safety
HHSE	Human Health Screening Evaluation
HHRA	Human Health Risk Assessment
HPS	Health Physics Society
HRS	(EPA) Hazard Ranking System
HSA	Historical Site Assessment
IAG	Inter-Agency Agreement
IEI	International Epidemiology Institute
IFB	Indistinguishable from Background
INEEL	Idaho National Engineering & Environmental Laboratory
ISE	Imminent and Substantial Endangerment
ISRA	Interim Source Removal Action
IWMB	(California) Integrated Waste Management Board
KCOP	Los Angeles TV Channel 13 (Copley Press former owners)
KEWB	Kinetics Experiment Water Boiler
kg	kilogram
KNBC4	Los Angeles NBC TV Channel 4
KPCC	Los Angeles National Public Radio Station, 89.3 FM
LA	Los Angeles
LADWP	Los Angeles Department of Water and Power
LARWQCB	Los Angeles Regional Water Quality Control Board
LLC	Limited Liability Company
LLNL	Lawrence Livermore National Laboratory
LOX	Liquid Oxygen



LLRW	Low-Level Radioactive Waste
LLRWF	Low-Level Radioactive Waste Forum
LTR	License Termination Rule
LNT	Linear No-Threshold Model
LUT	Look-Up Table
LUTV	Look-Up Table Value
M.A.	Master of Arts
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
M.D.	Doctor of Medicine
MDA	Minimum Detectable Activity
MDL	Method Detection Limit
mg/kg	milligram per kilogram
MIT	Massachusetts Institute of Technology
MOU	Memorandum of Understanding
M.P.H.	Master of Public Health
MRCA	Mountains Recreation & Conservation Authority
mrem/y	millirem per year
mSv/y	millisievert per year
MVE	Mountain View Estates
MVV	Mountain View Village
MWth	Megawatt (thermal)
NAA	North American Aviation
NaK	Sodium (Na) potassium (K) coolant
NASA	National Aeronautics and Space Administration
NBC	National Broadcasting Corporation
NBZ	Northern Buffer Zone (Northern Undeveloped Land)
NCP	National Contingency Plan
NCRP	National Council on Radiation Protection and Measurements
ND	Non-detect



NESHAP	National Emission Standards for Hazardous Air Pollutants
NIMBY	Not in my backyard
NIOSH	National Institute of Safety & Health
NNSA	(DOE) National Nuclear Safety Agency
NORM	Naturally Occurring Radioactive Material
NPDES	National Pollution Discharge Elimination System
NPL	National Priority List
NRC	(US) Nuclear Regulatory Commission
NRDC	Natural Resources Defense Council
OCAS	Office of Compensation Analysis Support
OCCD	Octachlorodibenzodioxin
ORAU	Oak Ridge Associated Universities
ORIA	(EPA) Office of Radiation and Indoor Air
ORISE	Oak Ridge Institute of Science and Education
OSTI	(US) Office of Scientific and Technical Information
OSWER	(EPA) Office of Solid Waste and Emergency Response
PAH	Polyaromatic Hydrocarbon
PA/SI	Preliminary Assessment / Site Inspection
PC	Probability of Causation
pCi/g	picocuries per gram
pCi/L	picocuries per liter
PDF	Portable Document Format
PEA	Preliminary Endangerment Assessment
Ph.D.	Doctor of Philosophy
PHI	Public Health Institute
PM _{2.5}	Particulate matter < 2.5 micron diameter
PM ₁₀	Particulate matter < 10 micron diameter
ppm	parts per million
PRA	(California) Public Records Act



PRG	Preliminary Remediation Goal
ProUCL	Statistical Software
PSR-LA	Physicians for Social Responsibility - Los Angeles
Pu-238	Plutonium-238
Pu-239	Plutonium-239
PWR	Pratt & Whitney Rocketdyne
QA	Quality Assurance
Q&A	Questions & Answers
QC	Quality Control
QST	QST Environmental Inc.
RA	Remedial Action
RAC	Risk Assessment Corporation
R/A	Radioactive
RAGS	(EPA) Risk Assessment Guidance for Superfund
RBRA	Radiological Background Reference Area
RCRA	Resource Conservation and Recovery Act
R&D	Research & Development
RD	Rocketdyne
RD-XXX	Identification number for SSFL groundwater wells
rem	roentgen equivalent man
RHB	(CDPH) Radiologic Health Branch
RI	Rockwell International
RIHL	Rockwell International Hot Laboratory
RI/RD	Rockwell International / Rocketdyne
RMDF	Radioactive Materials Disposal Facility
RMHF	Radioactive Materials Handling Facility (formally RMDF)
RP	Responsible Party
RRC	Radiological Reference Concentration
RSO	Radiation Safety Officer



RTG	Radioisotope Thermal Generator
RTL	Radiological Trigger Level
RWQCB	Regional Water Quality Control Board
SB	(California) Senate Bill
SCAQMD	South Coast Air Quality Management District
SCCHPS	Southern California Chapter of the Health Physics Society
SCFS	Southern California Federation of Scientists
SMMC	Santa Monica Mountains Conservancy
SNAP	Systems for Nuclear Auxiliary Power
SNM-21	Special Nuclear Material License No. 21
SOS	Save Open Space
Sr.	Senior
Sr-90	Strontium-90
SRAR	Southland Regional Association of Realtors
SRE	Sodium Reactor Experiment
SSFL	Santa Susana Field Laboratory
STP	Sewage Treatment Plant
SWLLRWCC	South-Western Low-Level Radioactive Waste Compact Commission
SWRCB	(California) State Water Resources Control Board
S8DR	SNAP 8 Developmental Reactor
S8ER	SNAP 8 Experimental Reactor
TAT	Teens Against Toxins
TCE	Trichloroethylene
TID	Technical Information Division
TMI-2	Three Mile Island, Unit 2
TRUMP-S	Transuranic Material Pyro-processing - Separation
TXXX	Area IV building numbering system, later changed to 4XXX
UAW	United Aerospace Workers Union
UC	University of California



UI	University of Illinois
UCL	Upper Confidence Limit
UCLA	University of California Los Angeles
UCS	Union of Concerned Scientists
UK	United Kingdom
US	United States
USAF	US Air Force
USC	University of Southern California
U.S.C.	United States Code
USEI	US Ecology, Idaho
USEPA	United States Environmental Protection Agency
USNRC	United States Nuclear Regulatory Commission
UPL	Upper Prediction Limit
USL95	Upper Simultaneous Limit such that all observations from the background dataset will be less than or equal to USL95 with a confidence coefficient of 0.95
UTL95-95	Upper Tolerance Limit exceeded less than 5% pf the time with a confidence coefficient of 0.95
VA	(US) Department of Veterans Affairs
VCAPCD	Ventura County Air Pollution Control District
VCEHD	Ventura County Environmental Health Division
VCFD	Ventura County Fire Department
VOC	Volatile organic compounds
WRS	Wilcoxon Rank Sum
Xe-135	Xenon-135
4XXX	Area IV building numbering system (superseded TXXX)
$\mu\text{g}/\text{m}^3$	micrograms per cubic meter
$^{\circ}\text{F}$	degrees Fahrenheit
aE-b	$a * 10^{-b}$



1.0 EXECUTIVE SUMMARY

Why did I write this report? Perhaps for the same reasons that you are reading it. There is a need for a single, one-stop source, to answer your question ... has SSFL operations impacted my health and my community?

For well over 30 years, the Santa Susana Field Laboratory (SSFL) has been in the public spotlight. That is more than a generation. During that time, major players in the story have come and gone. During that time, Rockwell/Boeing management at SSFL has changed over half a dozen times. Total Rockwell/Boeing employment at SSFL during that time has fallen from many hundreds to less than a dozen. During the last 30 years alone, the Department of Energy (DOE) Energy Technology Engineering Center (ETEC) site management has changed almost a dozen times. Leadership and staff at regulatory agencies, especially the Department of Toxic Substances Control (DTSC), have changed frequently. And other stakeholders have come and gone, have grown older, and admittedly grown in number. As a consequence, institutional knowledge of site history has been hard to maintain. Yes, DTSC and DOE websites attempt to maintain that environmental history, though usually it is in the form of “shopping lists” of disconnected documents. The newly interested community member doesn’t know where to start, or how events are linked, or why events occurred. I have worked at SSFL from 1990 to 2015 and have closely observed activities from a distance during my retirement since then.

The roadmap and timeline linking the material in this paper should provide the reader with a better understanding of why events happened as they did and what were the take-aways from the various studies and projects. This approach is hopefully more informative than the string of disconnected reports and communications that one typically sees on the [DTSC SSFL website](#). The narrative has benefitted from the knowledge acquired during my twenty-five years as Senior Manager of Radiation Safety at SSFL, intimately involved with most all events discussed. By necessity, the scope of this paper is focused on radiological aspects of onsite and offsite characterization, worker and community health studies, offsite exposure studies, and offsite waste disposal, subjects that were within my domain. If chemical aspects are less well covered, that is simply because characterization and remediation of chemical contaminants was the responsibility of others. The views and opinions expressed are mine alone, and do not necessarily reflect views or opinions of Boeing, DOE, or NASA.

Occasionally, the reader may see similarities between this content and the content of certain pages in the [DOE ETEC website](#). This is not plagiarism. Between 2005 and 2012, Boeing managed the DOE ETEC website for DOE. Indeed the website was initiated by Boeing at the request of Mike Lopez, then DOE ETEC Program Director. The majority of the DOE ETEC website content generated during that period was developed by the author. I am therefore re-using my own work product.



In contrast, little of the technical content of this paper can be found on [Boeing's Santa Susana website](#). The website does however have an extensive "frequently asked questions" page, as does the [DTSC SSFL website](#).

- [Boeing Santa Susana FAQs](#). Boeing Source.
- [SSFL Cleanup FAQs](#). DTSC Source.

Most "technical content" on Boeing's Santa Susana website is limited to stormwater management, regulated under a National Pollutant Discharge Elimination System (NPDES) permit issued by the Los Angeles Regional Water Quality Control Board (RWQCB), plus related Interim Source Removal Action (ISRA) programs. This is because the RWQCB included it as a permit requirement. This material is available on the "Technical Library" page.

- [Santa Susana Stormwater Technical Library](#). Boeing Source.

The Boeing Santa Susana website also intentionally distances itself from any and all nuclear/radiological topics, preferring to delegate those subjects to the DOE, even though Boeing and its predecessor companies were DOE's prime contractor for 60 years.

Typically, technical papers and reports are just that ... technical, dry, and clinical. However, this paper is in some ways autobiographical of my days at SSFL, and so the reader will occasionally come across some of my personal observations or transitions from the third person into the first person. This is done intentionally, and so hopefully the reader may gain some insight into the human face of Santa Susana.

By convention, direct quotes from independent third parties and from cited online documents are given in *"italics enclosed in quotation marks."* I have highlighted in yellow, key, important data-driven, conclusions, to facilitate a reader interested in the "bottom line." These highlights are not in the original text.

1.1 Objectives

Rather than celebrating the historical achievements of the site,¹ SSFL has received unprecedented negative attention from activist organizations, state and federal legislators, media, and the surrounding communities.

Their shared common, almost religious, beliefs can be summarized into four key areas.

- Routine operations and accidents have released large quantities of radionuclides and chemicals via air, surface water and groundwater that have migrated from the property ([Section 3.5](#) and [Section 4.0](#)),
- Therefore our local communities are heavily contaminated ([Section 8.0](#)),

¹ See Section 2.2 for historical perspective.



- Therefore our health has been negatively impacted ([Section 10.0](#)).
- Disposal of waste to landfills has negatively impacted the health of neighborhood communities surrounding those landfills ([Section 12.0](#)).

Although past operations at the site have resulted in contamination of the onsite soil and groundwater with chemicals and radionuclides, extensive sampling and monitoring of air, soil, groundwater, and surface water has been conducted such that the extent of contamination has been well characterized ([Sections 5.0](#), [Section 6.0](#) and [Section 7.0](#)).

Oversight of historical operations and more recent remediation has been conducted by various agencies including the Nuclear Regulatory Commission, California Department of Public Health - Radiologic Health Branch (DPH-RHB), DTSC, RWQCB, and the US Environmental Protection Agency (EPA).

Offsite media sampling ([Section 8.0](#)) has been conducted that has shown offsite impact from SSFL to be negligible to zero.

Community health studies ([Section 10.0](#)) have been conducted that have failed to establish any significant differences in cancer rates in local communities compared to LA and Ventura County averages and failed to establish any causal relationships between cancer rates in surrounding communities and past or current SSFL operations.

Offsite waste disposal ([Section 12.0](#)) has also been a favorite subject of attention. The allegation is that any waste generated in Area IV, whether it be soil, or building demolition debris, was assumed to be contaminated with radioactivity that would be harmful to the public and environment unless disposed of at a licensed low-level radioactive waste (LLRW) disposal site. This was based on the zero tolerance, cleanup-to-background, no-safe-level-of-radiation, philosophy that runs counter to federal and state decommissioning guidance. This has severely impacted the progress of the SSFL nuclear decommissioning program for the last 20+ years at SSFL. This is the subject of a companion paper, “Nuclear Decommissioning at SSFL: 20+ Years of Politics vs. Science.”² Several examples of legislator interference will be laid bare in [Section 10.0](#).

Nevertheless, some in the community continue to believe that their health has been impacted by SSFL. This belief continues to be stoked by activist organizations/individuals and legislators. This belief has become a religion.

² Rutherford, “Nuclear Decommissioning at the Santa Susana Field Laboratory: 20+ Years of Politics vs. Science.” Available at https://philrutherford.com/SSFL/Nuclear_Decommissioning_at_SSFL.pdf. Accessed October 25, 2022.



Though much of the material and online citations³ of this paper provide the facts from the author's point of view, citations to opposing views are also provided. This has been done to (1) provide a transparent, balanced review, and to (2) provide a context and framework for the many issues discussed and rebutted.

This paper will provide a timeline and roadmap of how two connected misconceptions have come to pass.

- There is contamination in my neighborhood
- This contamination has given me cancer

Both these myths will be shown to be false. The truth is,

- There is no widespread contamination in my neighborhood
- I cannot get cancer from non-existent contamination

I would understand if the reader was skeptical if it was only Boeing, or DOE or NASA taking this position, but simply skip to [Section 19.0](#) to see the myriad of individuals, organizations, and agencies who independently have come to these same conclusions.

1.2 Organization

The report is organized by subject that addresses and answers the key questions posed by the public relating to accident releases, onsite contamination, alleged offsite contamination, worker and community health studies, and offsite waste disposal. Each subject section is further organized chronologically so the reader can understand the flow of events.

[Section 2.0](#) provides the geographical location of SSFL in relation to neighboring communities, and the operational history of rocket engine testing and nuclear energy research at SSFL in the form of video and CGG.

[Section 3.0](#) discusses the early years in the late 1980s and the unprecedented public and media attention generated by (1) activist opposition to proposed nuclear research, (2) criticism of radiological monitoring programs by Greg Dempsey of EPA, (3) DOE's release of information about known contamination in Area IV, and (4) release of information on past accidents including the SRE accident.

[Section 4.0](#) discusses the SRE accident in depth ... what it was and what it was not ... and dispels the myth that it was the "*worst nuclear disaster in the US.*"

[Section 5.0](#) presents the results from three Area IV radiological characterization surveys culminating in the \$42 million EPA radiological survey in 2008-2012.

³ Online citations are shown in light blue font, sometimes as URLs in footnotes and sometimes as document titles in the body of the text.



Section 6.0 presents two historical site assessments including one conducted by the EPA utilizing over 200,000 digital historical documents provided by Boeing.

Section 7.0 provides source documents on onsite media sampling and monitoring from 1955 to the present day, including soil, air, groundwater, and surface water.

Section 8.0 provides data on offsite sampling over a 20-year period in eleven separate communities surrounding SSFL, conducted by both Boeing and numerous other independent organizations. The combined data has led the DTSC to conclude ***"DTSC has not found any evidence that contamination from research and testing operations at SSFL has posed or would pose a threat to human health or the environment outside the SSFL site boundaries."***

Section 9.0 presents two worker health studies. The last study, conducted by internationally renowned radiation epidemiologist, Dr. John Boice, concluded that, ***"The Rocketdyne workforce had a much lower overall mortality than the rate observed in the California population."*** and ***"There is no evidence that working conditions caused increased mortality in the Rocketdyne workforce."***

Section 10.0 shows data from eight community cancer studies conducted by California agencies and academia over a 25-year period. The combined evidence of these studies has failed to find that people living near SSFL are at an increased risk for developing cancers as a result of exposures from SSFL operations. This supports DTSC's conclusion on offsite sampling (Section 8.0).

Section 11.0 Describes one ATSDR study, and one ATSDR-sponsored study that reviewed the same pre-existing sampling data to evaluate hypothetical offsite exposures. A third study evaluated potential releases and exposures from the 1959 SRE accident.

Section 12.0 describes disposal of decommissioned material from former buildings and land that have been "released for unrestricted use" by federal and state agencies. It exposes the activist-legislator connection, that opposes established federal and state decommissioning standards, guidance, and regulations. The subject of this section is covered in more depth in the companion report, [Nuclear Decommissioning at the Santa Susana Field Laboratory: 20+ Years of Politics vs. Science](#).

Section 13.0 describes the monitoring and sampling following two historical fires, the Topanga Fire (2005) and the Woolsey Fire (2018), that burnt through a large percentage of SSFL. Monitoring during the fires and post-fire sampling demonstrated that, in both cases, no radionuclides or hazardous material travelled offsite as a result of the fires.

Section 14.0 discusses five EPA Superfund Evaluations conducted over a 20-year period. The 2003 evaluation of Area IV concluded that, ***"Radionuclides associated with historic Area IV research are not present at concentrations significantly above background in the soils surrounding residential communities."*** However the 2007 evaluation of SSFL as a whole



concluded that SSFL warranted listing on the National Priorities List (NPL) almost exclusively because of onsite TCE groundwater contamination. Nevertheless, the activist-legislature faction opposed the federal EPA conducting a CERCLA Superfund risk-based cleanup, preferring instead that the state DTSC be in charge of “cleanup-to-background” remediation.

Section 15.0 provides several PowerPoint presentations made to business groups, legislative bodies, legislative staff, community groups, and professional health organizations, that did not find a place in the other sections.

Section 16.0 provides several “letters to the editor” written to local newspapers by Boeing employees and others.

Section 17.0 illustrates some of the “serious” cartoons appearing in local print media with SSFL as the target.

Section 18.0 is just straight talk.

Section 19.0 is a rack-up of individuals, organizations and agencies demonstrating no offsite impact from SSFL.

1.3 Disclaimer

Neither my former employer, The Boeing Company, nor the Department of Energy, has approved this paper, neither has their approval been sought. No classified, confidential, company proprietary, or privileged information has been used or cited in this paper. Most all information is accessible in the public domain or is a matter of public record. The vast majority of source citations provided in text and footnotes are on public web sites, including DTSC and DOE. Numerous documents that are not available on these public web sites, are provided on www.philrutherford.com. Some of these citations are public domain in that they are communications to/from State or federal agencies and are subject to the California Public Records Act (PRA) or the federal Freedom of Information Act (FOIA). Other materials have been provided in briefings to the public, agencies, media, or legislative staff and are therefore also public domain. Relatively few online citations originate from Boeing’s Santa Susana website.

The source of online citations is indicated either by the explicit URL address in a footnote or by a source note in the text such as,

- DOE Source - <https://www.etec.energy.gov>
- DTSC Source - https://dtsc.ca.gov/santa_susana_field_lab
- Boeing Source - <https://www.boeing.com/principles/environment/santa-susana/>
- Author Source - <https://www.philrutherford.com>
- YouTube Source - <https://www.youtube.com/>
- Etc.



1.4 Acknowledgements

The author acknowledges his many former colleagues at Boeing's Santa Susana Field Laboratory (SSFL), its employees, management, contractors, consultants, and customers who strove for excellence in the projects discussed in this paper.

In particular, my thanks to members of the Radiation Safety Department since 1990, including Bob Tuttle (the department's former manager), Marlin Remley (former Director of Nuclear Safety & Licensing), John Moore, Jim Rowles, Frank Badger, Dave Hickman, Janice Edstrom, Gene Watson, Robin Duncan, Ray McGinnis, Jim Barnes (Radiation Safety Officer), Wilbur "Kit" Kittinger, Farley Dahl, Farai Idowu, Terry Dix, Allan Sabbagh, Brian Oliver, Ning Liu, Ryan Ford, Earl Sorrels, Judy McLaughlin, Rich Harcombe, Guy Ervin, Bob Bass, Dan Pritchett, James Brennan, Bill Schaeppi, Georgina Bryant, Karen Sinderman, Ron Como, Michael Byrd, John Finger, Beverly Hill, Ken Darcy, Richard Deschamps, Richard "Tennessee" Garret, Pat Liddy, Pat Just, John Shao, Paul Fletcher and Ms. Novak.⁴

At various times during my stay at SSFL, I also managed Environmental Remediation and Health & Safety personnel. My thanks also to those colleagues, including, Steve Shestag, Art Lenox, Michael Sullivan, Alan Nelson, Brian Sujata, Randy Ueshiro, Nina Mattera, David Chung, Brian Mossman, Pam Blandino, Neil Mukherjee, Bettina Leeney, Bob Mako, Mike Nagaoka, Brian Lam, Mark Spenard, and Neil Chisom,

1.5 How to Read this Report

This report is not a novel. The reader does not need to start at the beginning and trudge through to the end. Depending on your interests, you can jump to the relevant section. Do you want to learn more about the Sodium Reactor Experiment accident? Are you a resident of Bell Canyon, Dayton Canyon or Runkle Ranch and want to read about the sampling done and DTSC's conclusions. Have you attended the American Jewish University (Brandeis Bardin Campus) and were concerned with the KNBC4 hit piece on AJU several years ago? Do you want to learn more about worker and community health studies? Were you worried about the potential impact of the Topanga and Woolsey Fires?

Enjoy your read!

⁴ Ms. Novak was student intern whose first name I have forgotten. I apologize.



2.0 SANTA SUSANA FIELD LABORATORY

2.1 Geographical Location

The Santa Susana Field Laboratory (SSFL) site occupies 2,850 acres located in the Simi Hills of Ventura County, California, approximately 30 miles northwest of downtown Los Angeles. The SSFL is situated on rugged terrain with elevations at the site varying from 1,650 to 2,250 ft. above sea level (ASL). The location of the SSFL site in relation to nearby communities is shown in Figure 1. No significant agricultural land use exists within 19 miles of the SSFL site.

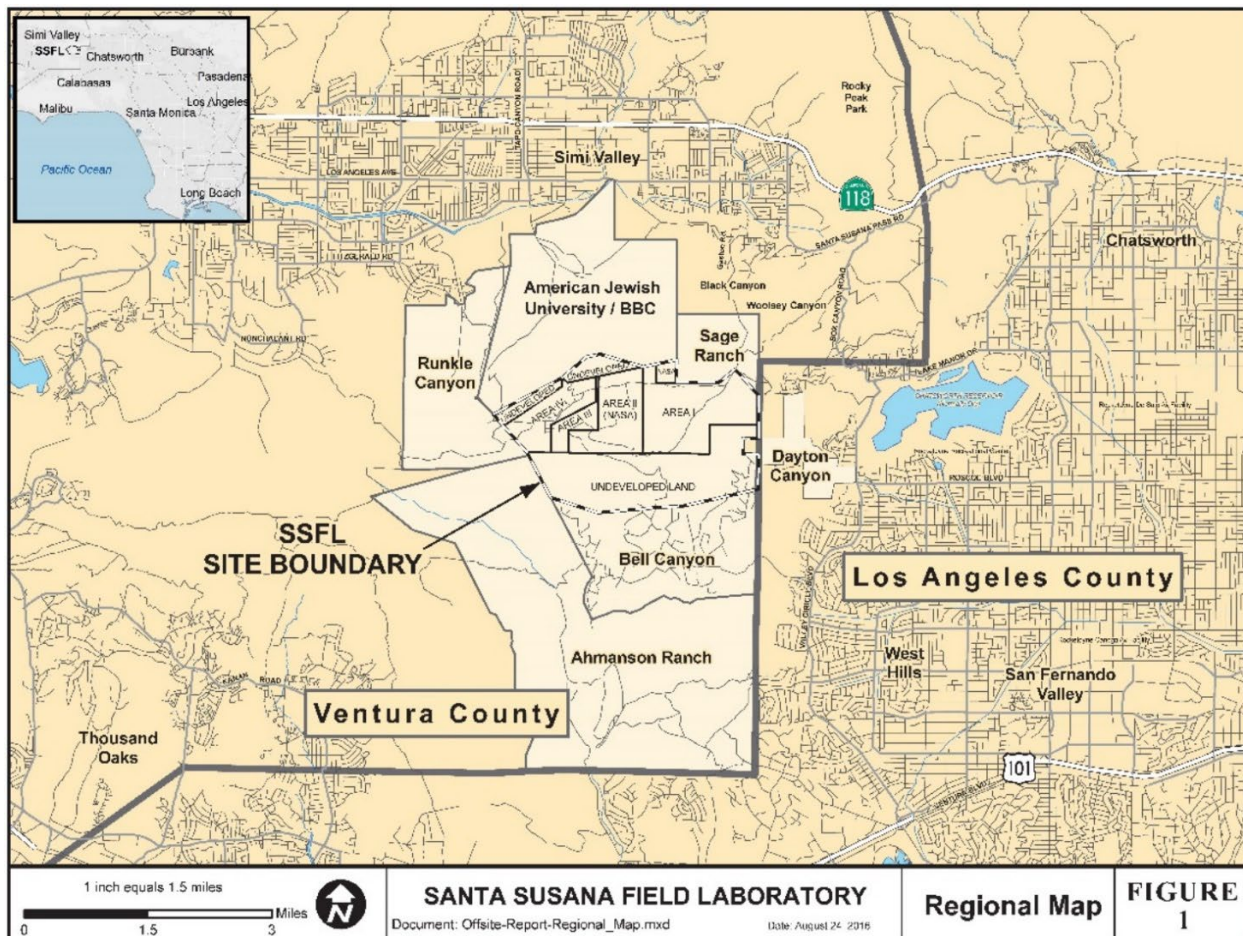


Figure 1. Location of SSFL in Relation to Local Communities

The site consists of four administrative areas and undeveloped land. Figure 2 illustrates the arrangement of the site together with the ownership. Areas I, II and III were used for rocket engine testing, initially for the Army Ballistic Missile Agency (ABMA), later the Air Force (AF), and more recently for the NASA. Area IV was used for energy research for the Atomic Energy



Commission (AEC), the Energy Research & Development Administration (ERDA) and DOE, principally liquid-metal-cooled nuclear power systems for terrestrial and space applications.⁵

Subdivisions			
Owner	Jurisdiction	Acres	Subtotals
Boeing	Boeing--Area IV	289.9	2,399.3
	Boeing—Area I and III	784.8	
	Boeing (Undeveloped land)	1,324.6	
Government	NASA (former AFP 57)	409.5	451.2
	NASA (former AFP 64)	41.7	
Total Acres			2,850.5

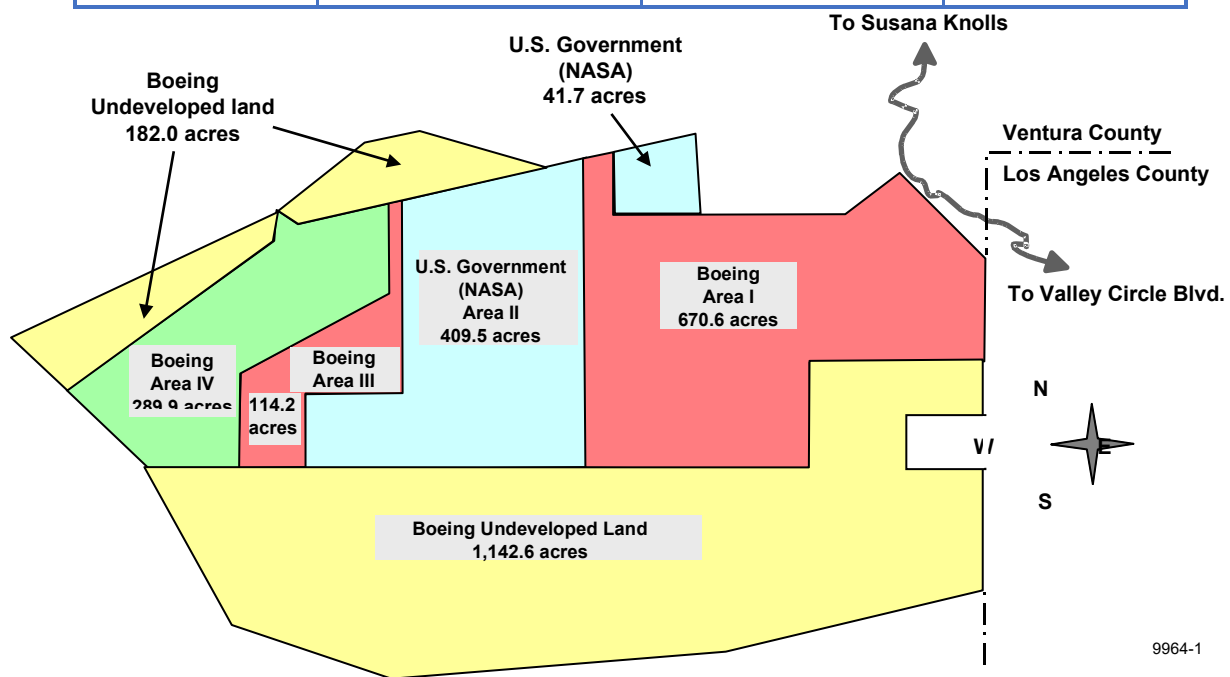


Figure 2. Santa Susana Field Laboratory Site Arrangement

⁵ Boeing, "Santa Susana's Extraordinary Past." Available at <https://www.boeing.com/principles/environment/santa-susana/extraordinary-past.page>. Accessed October 8, 2022



2.2 History

The Boeing Company has a brief summary of the history of SSFL. Boeing Source.

- [A Rich History at Santa Susana Field Laboratory](#)

A recommended book on the history of Rocketdyne is,

- Robert Kramer and Vince Wheelock, [Rocketdyne: Powering Humans Into Space](#)

NASA has a well-documented history of its rocket test programs at SSFL. NASA Source.

- [Overview - Video "Santa Susana: Propelling American Space Exploration"](#)
- [NASA, USAF & Army Rocket Engine Programs](#)
- [Operations](#)
- [Test Stand Activation](#)
- [Oral history of five former Rocketdyne employees](#)
- [NASA's Environmental Remediation Work Today](#)

The National Park Service and NASA coordinated to produce the following. NPS Source.

- [Virtual Tour of Test Stand Areas](#)
- [Documentation Project of SSFL](#)

The AEC funded nuclear reactor development for terrestrial power plants and satellites. YouTube Source.

- [Design and construction of the SRE](#) (July 1958)
- [SNAP 8 Reactor Program](#) (June 1963)
- [SNAP Aerospace Safety](#) (June 1963)
- [SNAPSHOT](#) (November 1964)
- [SNAP 10A Launch](#) (1965) Launch of the first and only US nuclear reactor in space.

DOE is responsible for environmental remediation at ETEC. DOE Source.

- [History and Current Environmental Remediation at ETEC](#)



3.0 THE EARLY YEARS

1989 was a momentous year. The Berlin Wall came down and the Soviet Union conducted its first "free" elections since 1917 that culminated in its ultimate breakup two years later.

In that same year, three events occurred at SSFL that combined to make a perfect storm.

- Application to renew the NRC SNM-21 License to perform the TRUMP-S⁶ program
- Publication of the DOE Environmental Survey of Area IV
- Criticism of the radiological environmental monitoring program by EPA

These events garnered continual media coverage, legislator's attention, and public outcry. All events fed the public's belief that SSFL was a health threat to their local communities.

3.1 Hot Lab SNM-21 License Renewal (1989-1990)

My first involvement with Santa Susana began in 1989. Before then, I had worked for the Atomics International Division (1978-1984) and the Rocketdyne Division (1984-1990) of Rockwell International at the De Soto Facility. I was responsible for reliability analysis and probabilistic risk assessment for terrestrial and space based nuclear power systems. In January 1989, I was appointed Manager of Nuclear Safety and Reliability Engineering.

In May 1989, Rocketdyne sought to renew its Nuclear Regulatory Commission (NRC) Special Nuclear Material (SNM-21) license to include planned work at the Rockwell International Hot Laboratory (RIHL) for reprocessing of transuranic waste. The TRUMP-S program was intended to investigate processes to separate long-lived transuranic radionuclides such as plutonium, americium, and neptunium from co-mingled shorter lived fission products like cesium-137 and strontium-90 and activation products such as cobalt-60. The results of this research would facilitate more effective waste disposal by minimizing volumes of high level and transuranic wastes.

However, anti-nuclear activist organizations, who oppose the whole nuclear life cycle, including blocking the establishment of all radioactive waste disposal sites and strategies, chose to oppose the TRUMP-S research project and the Hot Lab relicensing. This opposition quickly evolved into an NRC Administrative Hearing. The NRC appointed an administrative law judge, Judge Peter B. Bloch to oversee the legal challenge.

My boss, Clark Gibbs, Division Director of Atomics International (AI) and the Energy Technology Engineering Center (ETEC) tasked me with coordinating Rockwell's technical and legal response to the various opposition briefs that were being submitted by groups who became known as the "intervenors."

⁶ TRUMP-S stands for Transuranic Material Pyro-processing Separation



Over the period of July 1989 to April 1990 the hearing progressed. That period pre-dated the advent of email and since Rockwell's management, law department and communications department needed constant updating, my first task each morning was to call all three in turn and give them an update on the previous day's activities. Those nine months also coincided with my wife, Parvin's pregnancy with our first child. Chris was born March 4, 1990.

One month later, on April 4, 1990, Rocketdyne management, with the concurrence of Rockwell management, decided to cancel plans for the DOE-funded TRUMP-S program and transferred the program to the University of Missouri. Rocketdyne also announced that it would no longer pursue any further nuclear related research and operations at SSFL. Doubtless, the negative publicity that the NRC administrative hearing was generating, together with the coincident negative media coverage of the 1989 release of the DOE Environmental Survey (Section 3.3), influenced Rocketdyne's decision.

This probably appeared to be a wise decision from a company business and reputation point of view. However, I recall thinking that we had been betrayed by Rocketdyne management, and that past employees who had been at the forefront of nuclear power research would be disappointed with the decision to capitulate. Of course, the Rocketdyne Division, builder of rocket engines, had absorbed the Atomics International Division, six years previously, and it was thought that rocket scientists knew nothing of nuclear engineering. It was management's expectation (or hope) that by getting out of the nuclear business, the public attention would go away. This belief turned out to be wishful thinking.

Interestingly, thirty years later, Rocketdyne, is now named Aerojet Rocketdyne (AR), after several corporate mergers and acquisitions. Aerojet Rocketdyne is now researching nuclear powered rocket engines to propel missions to Mars and beyond,⁷ and providing radioisotope thermoelectric generators to power Moon and Mars rovers.⁸ Whatever the outcome, SSFL will not be part of those nuclear adventures.

The NRC administrative hearing was subsequently dismissed the following day on April 5, 1990.

Although Rocketdyne's withdrawal of the TRUMP-S plans pre-dated a final decision by Judge Bloch in the Hot Lab License Renewal hearing, Rocketdyne chose to submit to the NRC for the record, its final and full response to the intervenors claims. This was submitted on April 19, 1990.

⁷ Aerojet Rocketdyne, "Nuclear Propulsion." Available at <https://www.rocket.com/space/nuclear-propulsion>. Accessed October 20, 2022.

⁸ Aerojet Rocketdyne, "Aerojet Rocketdyne's MMRTG is Powering Perseverance Rover's Mission to Mars." Available at <https://www.rocket.com/media/news-features/aerojet-rocketdynes-mmrtg-powering-perseverance-rovers-mission-mars>. Accessed October 29, 2022.



- Rockwell, Letter from Phil Rutherford to Charles Haughney (NRC), [Rockwell International Corporation's Responses to the Intervenors' Concerns Pertaining to the SNM-21 License Renewal, Docket 70-25](#), April 19, 1990. Author Source.
- Rockwell, [Rockwell Responses to Intervenors' Concerns Pertaining to the SNM-21 License renewal Request, Volume I](#), RI/RD90-146, April 19, 1990. Author Source.
- Rockwell, [Rockwell Responses to Intervenors' Concerns Pertaining to the SNM-21 License renewal Request, Volume II \(Exhibits\)](#), RI/RD90-146, April 19, 1990. Author Source.

The cover letter included ...

- *"Rockwell has an interest in assuring a complete and accurate record relative to the concerns raised. Virtually all allegations by the intervenors were not substantiated in their direct cases. As a result, the docket currently contains a series of incorrect statements of facts, improper conclusions, and unsubstantiated claims with no response from Rockwell."*
- *"Rockwell has now reviewed all the intervenor concerns in their direct cases and prepared the enclosed response. To assure a complete, accurate and contemporaneous record, Rockwell hereby requests that the response be docketed as part of Rockwell SNM-21, Docket 70-25."*

Ultimately, ownership of the Hot Lab was transferred to the DOE. In 1996, following written assurances to NRC that the Hot Lab was being decommissioned in compliance with DOE health and safety regulations, and with no undue risk to the public health and safety, the NRC terminated license SNM-21.

- Rocketdyne, Letter from Phil Rutherford to Richard Turtill (NRC), [Request for Termination of USNRC Special Nuclear Material License SNM-21](#), February 2, 1996, DTSC Source.
- NRC, [Letter from Michael Weber \(NRC\) to Phil Rutherford, Untitled](#), August 13, 1996. DTSC Source.
- Rocketdyne, Letter from Phil Rutherford to Michael Weber (NRC), [Termination of NRC License SNM-21](#), August 23, 1996. DTSC Source.
- NRC, [Letter from Michael Weber \(NRC\) to Phil Rutherford, Untitled](#), September 27, 1996. DTSC Source.

3.2 Reviews of Radiological Environmental Monitoring Programs (1989-1991)

In 1989, Greg Dempsey of the EPA conducted a 3-day review of the radiological environmental program at SSFL. Mr. Dempsey's review report was critical of certain aspects of the program and is provided below. In addition Mr. Dempsey reported on a variety of onsite and offsite sample results in the second report below.



- EPA Memorandum from Greg Dempsey to Daniel Shane, [Site Visit to Santa Susana Field Laboratory](#), July 28, 1989. DOE Source.
- EPA Memorandum from Greg Dempsey to Rich Vaille, [Rocketdyne SSFL Site Sampling Analysis Report](#), November 8, 1989. DOE Source,

Subsequently, Rocketdyne commissioned two additional independent reviews. These reviews provided a more balanced assessment and took issue with some of the criticisms of the Dempsey report. Nevertheless, the reviews also made some recommendations for improvements. These two reports are provided below.

- J. D. Berger, Oak Ridge Associated Universities, [Review of Surplus Facilities Radiological Monitoring. SSFL, Ventura County](#), December 12, 1989. DOE Source.
- Daniel Montgomery, Analytics, [Peer Review of the Rockwell International SSFL Environmental Monitoring Program](#), May 31, 1990. DOE Source.

In 1991, Rocketdyne documented these reviews and described (1) corrective actions that addressed areas of improvement, and (2) provided rebuttal to invalid criticisms. This report is provided below.

- N001SRR140115, [Recent Reviews of Rocketdyne Radiological Environmental Monitoring](#), June 28, 1991. DOE Source.

Several of the more widely publicized criticisms were addressed below.

- **Soil is sampled for gross alpha and gross beta radioactivity** - While Rocketdyne maintained that gross alpha and gross beta was a valid screening technique for determining whether environmental contamination existed in soil, the company nevertheless committed to conduct isotope-specific analysis for all future soil samples. No gross alpha or gross beta analysis of soil samples has been conducted at SSFL since 1989. It is interesting to point out that the EPA themselves conducted gross alpha and gross beta analysis of soil samples in [Bell Canyon](#) in 1998. It is further interesting to note that the EPA relies on gross alpha and gross beta analysis for its principal drinking water screening analyses, presumably trusted these techniques to adequately protect the nation's drinking water supply.
- **Vegetation is washed to "remove contamination"** - The objective of vegetation analysis is to determine if any potential sub-surface soil contamination is taken up by the root structure. The objective is not to measure potential airborne fallout ... surface soil sampling was performed to measure potential airborne fallout. Attempting to measure potential airborne fallout from that quantity deposited on the surfaces of leaves would be an extremely unreliable method, given the propensity for such contamination to be either washed off by rainfall or blown off by wind. Therefore washing was very appropriate given the objective. With few exceptions, Rocketdyne ceased widescale vegetation sampling in 1989.



- **Soil and vegetation samples are heated to high temperature to "volatilize the contaminants"** - Rocketdyne was following established laboratory protocols. Heating of soil and vegetation samples is required since "activity per dry weight" is the conventional way of reporting sample results. This ensures a consistent measurement baseline that would be impossible with soil and vegetation samples of varying moisture content. Literature and subsequent experimentation demonstrated that volatilization of cesium compounds only occurs at more than twice the temperature to which soil samples were heated. Nevertheless Rocketdyne has not heated soil samples since 1989 and sends most samples to off-site state certified laboratories.

3.3 DOE Environmental Survey (1989)

In February 1989, DOE issued their preliminary findings based on the first phase of an environmental survey of DOE activities at SSFL. The survey had been conducted by DOE's Office of Environment, Safety and Health in May 16 through 26, 1988.

Media Attention



Figure 3. Daily News Reporting 1989 DOE Environmental Survey



The survey was part of the larger, comprehensive DOE Environmental Survey encompassing all major operating facilities of DOE. The DOE Environmental Survey was one of a series of initiatives announced on September 18, 1985, by Secretary of Energy, John S. Herrington, to strengthen the environmental, safety, and health programs and activities within DOE. The purpose of the environmental survey is to identify, via a "no-fault" baseline survey of all the Department's major operating facilities, environmental problems, and areas of environmental risk.

The report did not identify any issues that were not known by DOE's ETEC program office or its prime contractor, Rockwell International. However, the public issue of the report raised the attention of the media and local and federal legislators, notably, Simi Valley Representative Elton Gallegly and California Senator Barbara Boxer.

- DOE/EH/OEV-33-P, [Environmental Survey Preliminary Report - DOE Activities at Santa Susana Field Laboratories, Ventura County, California](#), February 1989. OSTI Source.

Although the preliminary report indicated that a final report would be issued based on comments from the San Francisco Operations Office, the author is not aware that any final report was issued.

3.4 Factual Perspective (1989 - 1991)

These events led to the publication of the "Factual Perspective", in an effort to communicate to the public the truth about nuclear operations at SSFL, the status of decommissioning and the levels of residual radioactivity. The co-author of the "Factual Perspective" was Dr. Joe Mills, my former Manager of Nuclear Safety and Reliability Engineering, though most of the content was provided by Bob Tuttle, the Manager of Radiation and Nuclear Safety.⁹ The first report was issued and circulated to the public in December 1989. Later revisions were issued in 1990 and 1991.

- Oldenkamp, R. D. and J. C. Mills, "Nuclear Operations at Rockwell's Santa Susana Field Laboratory - A Factual Perspective", Rockwell Document N001ER000017, Revision 0, December 20, 1989.
- Oldenkamp, R. D. and J. C. Mills, "Nuclear Operations at Rockwell's Santa Susana Field Laboratory - A Factual Perspective", Rockwell Document N001ER000017, Revision A, February 16, 1990.
- Oldenkamp, R. D. and J. C. Mills, [Nuclear Operations at Rockwell's Santa Susana Field Laboratory - A Factual Perspective](#), Rockwell Document N001ER000017, Revision B, October 2, 1990. Author Source.

⁹ Bob Tuttle worked at SSFL from 1960 to 1975 as a reactor physicist. He was Manager of Radiation and Nuclear Safety from 1975 to 1990.



- Oldenkamp, R. D. and J. C. Mills, [Nuclear Operations at Rockwell's Santa Susana Field Laboratory - A Factual Perspective](#), Rockwell Document N001ER000017, Revision C, September 6, 1991. DTSC Source.

This early attempt at community outreach and communication (pre-internet) was the embryo of what ultimately became the initial versions of the DOE ETEC website, www.etec.energy.gov and Boeing's internal SSFL Radiation Safety website.

One of the messages in the "Factual Perspective" was the chronological reduction in the inventory of man-made radioactivity at SSFL from the 1950s to 1989, and a comparison of that inventory to the inventory of naturally occurring radioactivity in the soil at SSFL. This pre-dated the subsequent computations of dose and risk, but actually addressed the issue in a way that was more understandable to the lay person. Subsequent estimates of soil "background" by EPA in 2009 ([Section 5.4](#)) and estimates of soil radionuclide inventory by RAC in 2019 following the Woolsey Fire ([Section 13.2.6](#)) are a natural progression of these initial estimates.

3.5 SSFL Work Group (1989 - 2020)

Simi Valley Representative Elton Gallegly sponsored the formation of the SSFL Work Group in 1989 following the DOE Environmental Survey in the previous section. Gallegly asked EPA Region IX to establish and chair an inter-agency workgroup with the intent of fostering improved communications between agencies, the responsible parties, and the public. The first meeting was held on December 14, 1989, and its charter was ...

- [SSFL Work Group Charter](#), September 27, 1990. Author Source.

I recall making presentations at numerous meetings during the early years of the Work Group. However, it soon became apparent that the Work Group was becoming a platform for Dan Hirsch's rants. Boeing was removed from a seat at the table and relegated to the audience, the Nuclear Regulatory Commission only attended a few early meetings. DHS/RHB quit attending in 2007. Boeing quit attending as a spectator before 2009. In 2012, EPA tired of the farce and quit as chair, with DTSC taking over as chair. In 2012 the DTSC discontinued the work group. Ultimately in 2014, the work group was reinstated to be coordinated by Denise Duffield of the activist group, Physicians for Social Responsibility - Los Angeles. Its meeting on February 4, 2015, consisted of "presentations" by Physicians for Social Responsibility, Teens Against Toxins, Rocketdyne Cleanup Coalition, Center for Race, Poverty, and the Environment (CRPE), and the Committee to Bridge the Gap.¹⁰ Truly a committee of unbiased experts! There is no evidence

¹⁰ SSFL Work Group, Agenda for Meeting 2015-02-04. Available at https://www.philrutherford.com/SSFL/SSFL_Work_Group/Agenda_SSFL_Work_Group_2015-02-04.pdf. Accessed October 8, 2022



that any agency or RPs were in attendance. Its website¹¹ reports only one meeting in the last six years, a far cry from the previous four meetings per year schedule. It appears that the SSFL Work Group has finally died a long-awaited death.

3.6 Past Accidents at SSFL (1980)

Before I became involved in SSFL, Dan Hirsch had prepared and circulated a two-page document, dated January 18, 1980.

- CBG, [Past Accidents and Areas of Possible Present Concern Regarding Atomics International](#), January 18, 1980. Author Source.

Dr. Marlin Remley, then Director of Nuclear Safety and Licensing, doubtless responded at the time. However I have been unable to locate that response.

During the 1980s there was little attention from the public, but that changed in 1989. The Hot Lab License renewal ([Section 3.1](#)) and the release of the DOE Environmental Survey of Area IV ([Section 3.3](#)) generated a perfect storm of media, legislator, and public attention. In July 1990, following my involvement in the NRC administrative hearing, I was asked to take over management of the Radiation Safety Department at SSFL. Bob Tuttle, the former manager of that department was retiring after 30 years of service. Dr. Marlin Remley had also retired several years earlier, and I essentially took over both roles. At the time Clark Gibbs, Division Director of Atomics International and ETEC said I would be “working myself out of a job” within 3 years, under the mistaken belief that the issues at SSFL could be quickly resolved. That short term assignment would occupy my time for the next 25 years while employed and another 7 years into retirement, and it is not over yet.

In January 1991, Rocketdyne responded to a request from the California Department of Health Services to formally respond to the Hirsch document from 1980.

- Rocketdyne, Letter from Phil Rutherford to R. L. Holtzer, “[Nuclear Activities at Rocketdyne](#),” 91ETEC DRF-54, January 16, 1991. DTSC Source.

Hirsch had referred to ten “accidents” at SSFL in his 1980 report with the implication that all these accidents had resulted in radiological releases to the surrounding communities. The response to Department of Health Services is amplified in [Past Accidents](#).

¹¹ SSFL Work Group. Website available at <https://www.ssflworkgroup.org/meeting-reports/>. Accessed September 19, 2022.



4.0 SODIUM REACTOR EXPERIMENT

4.1 SRE Fuel Damage Accident (1959)

Without a doubt, the 1959 accident at the Sodium Reactor Experiment (SRE) was the lightning rod that inflamed the passions of Dan Hirsch and has stoked the anti-SSFL zeal of Hirsch and his many followers to the present day. It is likely that without the impetus of the SRE accident, Hirsch's interest would have waned, and his subsequent followers would not have materialized. It is doubtful that issues surrounding chemical remediation would have engendered as much passion as the "scary specter of nuclear meltdowns, radiation, contamination and cancer."

The story goes that during his campaign against the re-licensing of the UCLA teaching reactor in 1980, his student colleagues stumbled upon a set of old Atomics International documents in the bowels of the UCLA library.

Chauncey Starr¹² had been President of Atomics International from 1955 to 1966, after which he became Dean of Engineering at UCLA from 1966 to 1972. Starr had presumably taken AI documents with him to UCLA, that found their way into the library. Starr left UCLA in 1972 to form and become the first President of the Electric Power Research Institute (EPRI) in Palo Alto. These documents that Hirsch's team found in 1980 included information on the SRE accident.

Hirsch lost no time in attacking Atomics International, characterizing the accident as a secret cover-up of a meltdown and the worst nuclear accident in the US. See [Section 3.5](#).

4.2 SRE Presentations

Several PowerPoint briefings prepared by the author on the SRE and SRE Accident, include,

- [Sodium Reactor Experiment: Facts about the SRE Accident](#). November 19, 2021. Update to the October 29, 2014, version correcting obsolete URL links. Author Source.
- [Facts about the SRE Accident](#) (Short version 7 slides). October 20, 2014. Prepared for presentation to the Woodland Hills-Warner Center and Canoga Park Neighborhood Councils. This presentation was withdrawn by Boeing management shortly before the meeting. Author Source.
- [Facts about the SRE Accident](#) (Long version 45 slides). October 29, 2014. Author Source.
- [Sodium Reactor Experiment](#). November 10, 2006. Knowledge Management Seminar. Presented to the staff of Pratt & Whitney Rocketdyne. Author Source.
- [Sodium Reactor Experiment](#), July 2004. DOE Source.

¹² ANS, "Chauncey Starr - Biography", Available at <https://www.ans.org/about/presidents/cstarr/>. Accessed August 21, 2022.



Several slides extracted from the above presentations lay to rest the fallacy that the SRE accident was worse than Three Mile Island 2.

Table 1. SRE Compared to Three Mile Island, Unit 2

SRE is NOT Comparable to Three Mile Island

	SRE	TMI-2
Power Level (MWth)	20	2,568
Fission product inventory (curies)	1.1 million	10,000 million
Mass of fuel (metric tons)	3	138
Mass of fuel melted (metric tons)	0.03 - 0.9 (1% - 30%)	62 (45%)
Maximum Fuel Temperature (°F)	1,400	>5,200
Mass of molten fuel that formed a pool at the bottom of reactor vessel (metric tons)	0 (0%)	18 (13%)
Total fission products released (curies)	28	2.4 million - 13 million



Table 2. SRE Core Behavior

Meltdown or No Meltdown?

What Did Happen in the SRE?	What Did <u>NOT</u> Happen in the SRE?
Small amount (~1%) uranium-steel alloy melted in central region of the reactor core	Majority of fuel did not melt.
Reactor was shutdown and power level decreased	No super-critical power excursion
Molten material re-solidified in cooler lower portions of core	No pool of molten fuel in bottom of reactor vessel
Fuel remained fully immersed (and cooled) in pool of sodium coolant	No loss of coolant or cooling function
Power supplies to the reactor remained operable	No loss of offsite or onsite emergency power
Reactor vessel, surrounding concrete shielding and reactor building remained intact	No melt-thru of reactor vessel
Most cesium-137 and iodine-131 retained in fuel or retained in the coolant	No release of cesium-137 or iodine-131 to environment
	No over-pressurization of reactor building
	No hydrogen explosions
	No catastrophic loss of building integrity

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Phil Rutherford, 11/13/2021, SRE_2014-10-29.pptx | 36



Table 3. SRE Accident Compared to Other Nuclear Accidents

SRE is NOT Comparable to Other Nuclear Accidents

Abnormal Events	SRE	TMI-2	Fukushima	Chernobyl
Super-critical power excursion	No	No	No	Yes
Reactor core explosive disassembly	No	No	No	Yes
Loss of off-site power supplies	No	No	Yes	N/A
Loss of on-site emergency power supplies	No	No	Yes	N/A
Loss of coolant from reactor vessel	No	Yes	Yes	N/A
Loss of cooling function	No	Yes	Yes	N/A
<i>Melting of major portion of nuclear fuel</i>	No	Yes	Yes	N/A
<i>Pool of molten fuel in bottom of reactor vessel</i>	No	Yes	Yes	N/A
<i>Molten fuel penetrates reactor vessel</i>	No	No	Yes	N/A
Reactor building pressurized with steam	No	Yes	Yes	N/A
Hydrogen explosions	No	Yes	Yes	N/A
Catastrophic loss of building integrity	No	No	Yes	Yes

4.3 SRE Videos

Three historical videos documenting key events in the life cycle of the SRE were discovered by the author in 2005. These movies were in 16 mm film format. These were converted to digital format by the Rocketdyne Film Department and were eventually posted to the ETEC website. From there, they were downloaded by numerous outside parties and posted on the internet. Many versions can be found on YouTube. As of August 2022, the ETEC web site versions are unplayable as the format uses Adobe Flash Player, which is no longer supported. The links below are the author's YouTube channel.

- [SRE Construction](#) (July 1958) Construction of the Sodium Reactor Experiment at Santa Susana. YouTube Source.
- [Accident Recovery](#) (November 1961) Description of the 1959 SRE core damage accident and the procedures used to remove damaged fuel and refurbish the SRE for continued operation. YouTube Source.



- [Decommissioning](#) (March 1982) Description of the decommissioning and decontamination of the SRE prior to its release for unrestricted use. YouTube Source.

Another video discovered in 2005 was a 1958 episode of “Science Lab”, a TV show on Channel 13 KCOP, Los Angeles, hosted by Al Renner, a science teacher at Elliot Jr. High School in Pasadena California. His guests on this episode were Dr. Robert Loftness from Atomics International and Ms. Doreen Melindy, a high school student. The trio toured the Atomics International facilities in Canoga Park and the Santa Susana Field Laboratory including the L-47 reactor, the Sodium Reactor Experiment, and the Hot Lab. This counters the myth that the nuclear research of Atomics International was kept secret and no-one knew of it.

- [Science Lab](#) (1958). YouTube Source.

The SRE was featured on the Ed Murrow “See It Now” show when, on November 12, 1957, the SRE was the first nuclear power plant to be connected to the commercial power grid and lit the nearby city of Moorpark, California. This further dispels the secrecy myth.

- Ed Murrow “See It Now” Show. November 24, 1957. Unavailable.

Figure 4 shows a story from the November 1957 edition of Atomics International’s employee newspaper, “Skywriter”, describing the upcoming Ed Murrow Show.



SEE IT NOW—Cameraman Leo Rossi films demonstration of atomically-generated arc used in SRE dedication for showing on Edward R. Murrow "See It Now" TV program next Sunday on Channel 2. AI Cameraman Hal Williams, sec-

ond from right, also films demonstration park, in Simi Valley, will be included. Town was cut off normal "juice" by Edi

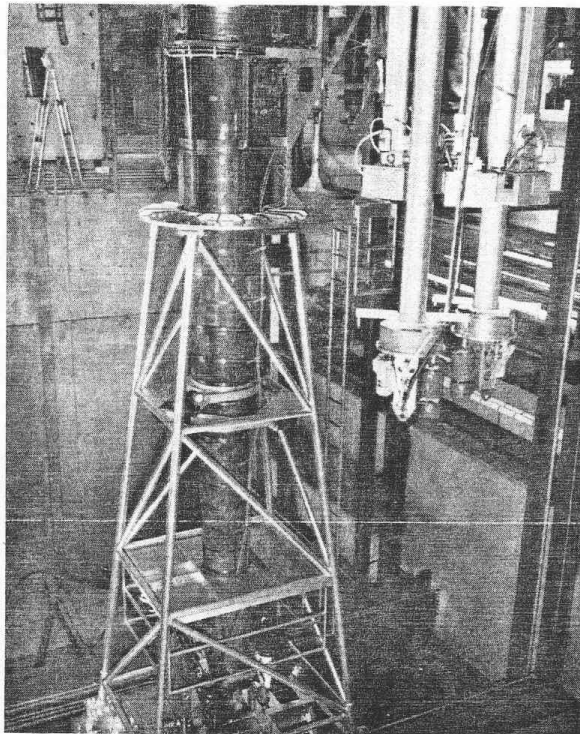
TV Show Sunday to Include Shots Filmed at SRE

Filmed scenes of Atomics International's Sodium Reactor Experiment (SRE)—including shots of the reactor control room, the reactor building and the top of the reactor core—are scheduled for showing on the Edward R. Murrow television program, "See It Now", this Sunday at 5 p.m. on Channel 2.

Columbia Broadcasting System cameramen made the film for Murrow's show, which will feature atomic energy projects in the United States and abroad. An interview with Lewis L. Strauss, chairman of the Atomic Energy Commission, was filmed for the program.

Moorpark Lighting

Also planned for the show were scenes of the lighting of the Simi Valley town of Moorpark. On Tuesday evening last week the "See It Now" camera crew pointed their lenses at the community of 1146 people as Southern California Edison Co. engineers "blackened out" the town for about 20 seconds. A switch was then closed and about 1000 kw. of electricity generated by Edison from heat produced in the SRE lighted Moorpark homes and industries.



BIRD'S EYE VIEW—CBS Director Arthur Morse, left, chose fuel handling cask as vantage point for cameras to film SRE for "See It Now" TV show, which is to be telecast next Sunday.

Classified Ads

FOR SALE—

North American's current backlog of unfilled orders amounts to \$581,000,000, the said, has a greater technical and production capability than ever before, and intends to con-



Figure 4. First Nuclear-Powered Commercial Electricity



4.4 SRE Accident Reports

One of the many myths perpetrated about the SRE accident is that it was kept secret and that Dan Hirsch was the first to inform the public in 1980. Nothing could be further from the truth. It is certainly true that the initial notification to the local media was non-informative and an attempt to downplay the event.

- Atomics International, [News Release](#), August 29, 1959. DOE Source.

However, several reports were written shortly after the 1959 Sodium Reactor Experiment accident that described events in great detail.

- NAA-SR-4488, [SRE Fuel Element Damage - Interim Report](#), November 1959 (700 copies printed). DOE Source.
- NAA-SR-4488-Supl, [SRE Fuel Element Damage - Final Report](#), June 1961 (700 copies printed). DOE Source.
- NAA-SR-6890, [Distribution of Fission Product Contamination in the SRE](#), March 1962 (830 copies printed). DOE Source.

Each of these reports included a front piece stating, *"This report has been distributed according to the category "Reactors - Power" as given in "Standard Distribution Lists for Unclassified Scientific and Technical Reports" TID-4500 (15th Ed.), August 1, 1959. Additional special distribution has been made. A total of XXX copies has been printed."* [Underlines added for emphasis]. Clearly information on the SRE accident was given wide circulation in the scientific community in this pre-internet era.

In 1960-61, many "lessons learned" papers were subsequently submitted to periodicals and presented at professional society conferences informing the nuclear industry and regulatory authorities on the causes and recovery from the accident. These include ...

- Dickinson, Robert W., [Coolant Block Damages SRE Fuel](#), Nucleonics, Vol. 18, No. 1, page 107, January 1960. DOE Source.
- Lewis, R. A., Detection of Sodium Reactor Experiment Moderator Can Damage, Transactions of the American Nuclear Society, Vol. 3, No. 2, December 1960
- Dickinson, Robert W., [SRE Operating Experience](#), Nuclear Safety, March 1961. DOE Source.
- Durand, Dick, [Sodium Reactor Operating Experience](#), Chemical Engineering Progress, Volume 57, No. 3, March 1961. DOE Source.
- Glasgow, Lyle, [Sodium Reactor Experiment](#), Proceedings of the Symposium on Sodium Reactors Technology, May 24-25, 1961. DOE Source.
- NAA-SR-4515, [Metallurgical Aspects of SRE Fuel Element Damage Episode](#), October 15, 1961 (620 copies printed). DOE Source.



- NAA-SR-6359, [SRE Core Recovery Program](#), December 1, 1961 (670 copies printed). DOE Source.

In 2005, two independent studies were completed that confirmed earlier findings that only small quantities of noble gases were released following the accident and that no iodine-131 or cesium-137 was released.

- [Chemical Behavior of Iodine-131 During the SRE Fuel Element Damage in July 1959](#), Jerry D. Christian Ph.D., May 26, 2005. DOE Source.
- [Investigation of Releases from Santa Susana Sodium Reactor Experiment in 1959](#), John A. Daniel Sr., May 27, 2005. DOE Source.

Dr. Jerry Christian was a past Scientific Fellow from the Idaho National Engineering and Environmental Laboratory (INEEL) and was an expert in nuclear fuel chemistry and the behavior of fission products in nuclear fuel. John Daniel participated in the decontamination and recovery of the Three Mile Island (TMI) nuclear plant. He is an expert on nuclear power plant safety analysis and fission product transport and behavior.

The principal conclusions of these two independent studies were:

- Only very limited melting of an iron-uranium eutectic (alloy) occurred, causing failure of the steel cladding.
- Nearly all of the iodine-131 in the reactor stayed in the fuel as uranium triiodide, a solid. No elemental iodine-131 vapor was released.
- Approximately 1% of the iodine-131 (16 curies) was released from the fuel into the sodium coolant in the reactor core. It then formed sodium iodide, a solid, and stayed in the reactor coolant system.
- Approximately 1% of cesium-137 (28 curies) was released from the fuel into the sodium coolant in the reactor core, and all of this cesium-137 stayed in the reactor coolant system.
- Measurements of the reactor cover gas indicated only noble gases (xenon-133 and krypton-85) were present. No iodine-131 or cesium-137 was detected in the cover gas, which is contrary to the alleged pathway for release through the stack, as theorized by the Lochbaum Report.
- Only very limited quantities of noble gases (xenon-133 and krypton-85) were released to the environment from the stack.

4.5 SRE Meteorological Data (2007)

Meteorological data during the period of the SRE accident was of interest to the neighboring community and its representatives for a number of years. While this 50-year-old data proved



difficult to locate, it was eventually found and immediately provided to the ATSDR, the USEPA and made publicly available on the DOE ETEC website.

- [Letter from Representative Elton Gallegly to Tom Gallacher \(Boeing\), Untitled](#), October 10, 2006. Author Source.
- [Letter from Tom Gallacher \(Boeing\) to Representative Elton Gallegly, Untitled](#), October 25, 2006. Author Source.
- Letter from Tom Gallacher (Boeing) to Burt Cooper (ATSDR), [Sodium Reactor Experiment, Meteorological Data 1952-1963](#), September 7, 2007. DOE Source.
- DOE/ETEC, [SRE Meteorological Data](#). DOE Source.

4.6 DOE SRE Workshop (August 2009)

On August 29, 2009, close to the 50th anniversary of the SRE Accident, the DOE hosted a day-long public workshop.¹³ The material below is taken directly from DOE's ETEC website.

"Some people believe that the July 1959 accident involving the Sodium Reactor Experiment was the worst nuclear accident in US history. Others believe the accident was much more benign. In response to stakeholder requests for more information about what happened, DOE hosted an informational workshop on August 29, 2009, designed to explore the diverse expert and community perspectives on what occurred prior to, during, and immediately after the accident."

"The workshop began with presentations from three independent experts: Dr. Paul Pickard of Sandia National Laboratories, Dr. Thomas Cochran of the Natural Resources Defense Council, and Dr. Richard Denning of Ohio State University. Over 185 workshop attendees then had an opportunity to ask questions of these experts. Finally, community members had an opportunity to provide their own perspectives on what occurred."

"A video documenting the workshop is presented below in segments separated by topic."

- [DOE Introductory Comments](#). YouTube Source.
- [Presentation: Dr. Paul Pickard, Sandia National Laboratories](#). YouTube Source.
- [Presentation: Dr. Thomas Cochran, Natural Resources Defense Council](#). YouTube Source.
- [Presentation: Dr. Richard Denning, Ohio State University](#). YouTube Source.
- [Q&A Session](#). YouTube Source.
- [Diverse Perspectives on the SRE Accident](#). YouTube Source.

¹³ DOE, "SRE Workshop." Available at https://www.etec.energy.gov/Community_Involvement/Public%20Meetings/SRE_Workshop.php. Accessed August 29, 2022



“Other items from the workshop are available here, including:”

- *The agenda for the workshop.* DOE Source.
- *Dr. Pickard’s PowerPoint presentation.* DOE Source.
- *Dr. Cochran’s PowerPoint presentation.* DOE Source.
- *Dr. Denning’s PowerPoint presentation.* DOE Source.
- *Biographical information about the three presenters.* DOE Source.
- *A handout designed to help community members develop their own statements regarding their perspectives on the accident, which includes [summary descriptions of the accident](#) prepared by Dr. Pickard and Dr. Denning.* DOE Source.
- *A handout prepared by Dr. Cochran [summarizing his perspective](#) on what occurred during the accident.* DOE Source.
- *A [glossary of terms](#) related to radioactivity and operations of the SRE facility.* DOE Source.
- *A [library](#) of over 80 documents, articles, text book descriptions, and symposia proceedings describing the design, operations, causes of the accident, activities taken to recover and restart the reactor, and decommissioning of the reactor facility.* DOE Source.
- *Workshop posters presenting, timelines for the SRE history and Run 14, details regarding the operation of the SRE and the accident, and radioactive production and decay of the SRE reactor inventory.*
 - *[Sodium Reactor Experiment Timeline.](#)* DOE Source.
 - *[Timeline for Sodium Reactor Experiment Run 14 - July 12, 1959, to July 26, 1959.](#)* DOE Source.
 - *[Sodium Reactor Experiment Operation and Accident.](#)* DOE Source.
 - *[Radioactive Production and Decay of SRE Reactor Inventory.](#)* DOE Source.

In support of the workshop DOE also posted on its ETEC website, 82 historical documents related to the SRE.¹⁴

Also in support of the workshop, DOE invited ex-employees and community members to bus tours of the SSFL, focusing on the nuclear operations in Area IV. Six separate tours were held over a three-day period. The author was tour guide for all six tours.

¹⁴ DOE, “SRE Historical Library Documents, added August 12, 2009.” Available at https://www.etec.energy.gov/Library/Historical_Docs.php. Accessed September 18, 2022.



5.0 RADIOLOGICAL CHARACTERIZATION SURVEYS

There have been three radiological characterization surveys of Area IV. The first was conducted in the late 1980s by Jeff Chapman and members of the Radiation & Nuclear Safety Department. The second was conducted in the mid-1990s by Rocketdyne personnel and funded by DOE at a cost of approximately \$3 million. The second was conducted from 2008-2012 by Hydrogeologic under contract to EPA and funded by DOE. It cost \$42 million.

5.1 DOE SSFL Site Radiological Survey (1987-1988)

In 1987-1988, a comprehensive radiological inspection was performed by Rocketdyne on behalf of the DOE at 25 locations within Area IV of SSFL. The purpose of this survey was to determine if radioactive contamination existed to such an extent that further inspection or decontamination was warranted. These locations, as identified by the "Radiological Survey Plan for SSFL", included facilities and areas where radioactive materials were used (or possibly used) to support AEC, ERDA, and DOE programs. Because these locations were not included in a government-funded maintenance and surveillance or decontamination and decommissioning program, the objective of this survey was to identify areas requiring decontamination before release for unrestricted use.

The radiological survey began in August of 1987 and reporting was completed in October 1988. Some specific locations were identified as having residual radioactivity at levels requiring decontamination, however, no hazard was identified for employees, the environment, or neighboring communities. The executive summary is a brief overview of the guidelines, conditions, and sampling techniques used in the performance of this survey, and a presentation of the major radiological findings.

The following reports document the facilities and areas surveyed.

- 154SRR000001, Radiological Survey Plan for SSFL, September 25, 1985
- GEN-ZR-0015, [Executive Summary of DOE SSFL Site Radiological Survey](#), August 1988. DOE Source.
- GEN-ZR-0003, [Radiological Survey of Building T005](#), February 1, 1988. DOE Source.
- GEN-ZR-0004, [Radiological Survey of the Sodium Disposal Facility - Building T886](#), June 3, 1988. DOE Source.
- GEN-ZR-0005, [Radiological Survey of the Source and Special Nuclear Material Storage Vault - Building T064](#), August 1988. DOE Source.
- GEN-ZR-0006, [Radiological Survey of the Old Calibration Facility - Building T029](#), August 1988. DOE Source.
- GEN-ZR-0007, [Radiological Survey of Shipping/Receiving and Old Accelerator Area - Building T641 and T030](#), August 1988. DOE Source.



- GEN-ZR-0008, [Radiological Survey of the Old ESG Salvage Yard, Rocketdyne Barrel Storage Yard, and New Salvage Yard \(T583\)](#), August 1988. DOE Source.
- GEN-ZR-0009, [Radiological Survey of the T513 Parking Lot; Old R/A Laundry Area; Plot 333; and Areas Between the SRE-to-RMDF, and KEWB-to-RMDF](#), September 1988. DOE Source.
- GEN-ZR-0010, [Radiological Survey of Building T019 and T013; An Area Northwest of T059, T019, T013, and T012; and A Storage yard West of Buildings T626 and T038](#), September 1988. DOE Source.
- GEN-ZR0011, [Radiological Survey of the T056 Landfill; Area from 23rd Street to Building T100; and an Area Across from Building T011](#), September 1988. DOE Source.
- GEN-ZR-0012, ["Radiological Survey of Building T373 and T375](#), September 1988. DOE Source.
- GEN-ZR-0013, [Radiological Survey of Buildings T049, T042, T027, T032, and T025](#), September 1988. DOE Source.
- GEN-ZR-0014, [Radiological Survey of Building T009](#), October 6, 1988. DOE Source.

Note that these pro-active surveys, were completed in a little over a year and were reported prior to the release of the 1989 DOE Environmental Survey discussed in [Section 3.3](#).

5.2 Area IV Radiological Characterization Survey (1994-1996)

A second radiological characterization study was conducted from March 1994 through September 1995 in Area IV of the Santa Susana Field Laboratory (SSFL). The purpose of the study was to locate and characterize any previously unknown areas of elevated radioactivity in Area IV. It focused on those regions of Area IV which were thought to be free of radioactive contamination (i.e., had not been identified previously as locations of activities involving radioactive materials), and thus had not previously been surveyed.

The following are the major plans and procedures that were used to guide the survey.

- A4CM-AN-0001, Area IV Characterization - Project Management Plan, March 1, 1994
- A4CM-AN-0002, [Area IV Characterization/Monitoring/Surveillance Program Health and Safety Plan](#), Rev. B, July 14, 1994. DOE Source.
- A4CM-AN-0003, [Radiological Characterization Plan, SSFL Area IV](#), Rev. A. March 30, 1994. DOE Source.
- A4CM-QN-0001, [Quality Assurance Plan for Area IV Characterization, Monitoring & Surveillance Program](#), March 14, 1994. DOE Source.
- A4CM-SP-0001, [Area IV Characterization Project - Gamma Survey Procedure](#), Rev. A. September 20, 1994. DOE Source.
- A4CM-SP-0002, [Area IV Characterization Project - Soil Sampling Procedure](#), Rev. A. December 2, 1994. DOE Source.
- A4CM-SP-0003, [Area IV Characterization Project - Water Sampling Procedure](#), Rev. A. March 10, 1995. DOE Source.



- A4CM-ZN-0004, "[Area IV Radiological Characterization Field Sampling, Analysis and Data Management Plan](#)", July 29, 1995. DOE Source.

The radiological status of Area IV was investigated by three complementary methods: ambient gamma survey, surface gamma scan survey, and soil sampling and analysis. Several locations exceeding, then current, dose-based soil cleanup standards were identified. All were subsequently remediated. Other locations were identified, that exceeded local background for cesium-137, but were well within the wider range US background, and were below the cesium-137 cleanup standard of 9.2 pCi/g. Other radionuclides were typical of background. There was no evidence of significant, widespread contamination, demonstrating that Area IV did not pose a threat to our neighbors. The following are the four volumes of the Area IV Characterization Survey final report.

- Rocketdyne, Transmittal Letter, [Area IV Radiological Characterization Survey Report](#), ETEC-96DRF-0453, August 30, 1996
- A4CM-ZR-0011, [Area IV Radiological Characterization Survey - Final Report - Volume I](#), Rev. A. August 15, 1996. DOE Source.
- A4CM-ZR-0011, [Area IV Radiological Characterization Survey - Final Report - Volume II](#), August 15, 1996. DOE Source.
- A4CM-ZR-0011, [Area IV Radiological Characterization Survey - Final Report - Volume III](#), August 15, 1996. DOE Source.
- A4CM-ZR-0011, [Area IV Radiological Characterization Survey - Final Report - Volume IV](#), August 15, 1996. DOE Source.

The following factsheets provided to the public summarized the survey plan and survey results.

- Rockwell, [Speaking of the Santa Susana Field Laboratory - Area IV Radiological Characterization Study](#), August 1995. DOE Source.
- Rockwell, [Area IV Radiological Characterization Study](#), September 1996. DOE Source.

EPA and the Committee to Bridge the Gap provided comments in April 1997 after reviewing the final report.

- EPA, [Area IV Radiological Characterization Survey](#), April 8, 1997. DOE Source.
- Committee to Bridge the Gap, [Comments on Environmental Monitoring Activities at the Rocketdyne Santa Susana Field Laboratory](#), April 7, 1997. DOE Source.

Boeing responded by letter to these comments in June 1997 and later in a briefing given to EPA in October 2002 and finally in the Area IV Environmental Assessment in March 2003.

- Rocketdyne, Letter from Phil Rutherford to Tom Kelly (EPA), "[SSFL Area IV Radiological Characterization Survey - Response to Comments](#)", June 5, 1997. DOE Source.



- Rocketdyne, Presentation to EPA Region IX, [1994-95 Area IV Radiological Survey](#), October 4, 2002. DOE Source.
- DOE, Appendix E of ETEC Environmental Assessment, [Soil Sampling Data](#), March 2003. DOE Source.

5.3 EPA Area IV Radiological Study (2008-2012)

In July 2008, DOE and USEPA signed an Inter-Agency Agreement (IAG) that called upon USEPA to conduct (1) a radiological background study, and (2) a radiological characterization study of Area IV and the northern buffer zone.¹⁵ DOE would ultimately pay \$41.5 million to USEPA for the studies but did not direct the study. This agreement concluded an almost decade of discussions for such a USEPA survey.

At the time, the goal was to compare soil sample radionuclide concentrations to the USEPA's agricultural preliminary remediation goals (PRG) (as of January 1, 2007), as mandated by Senate Bill (SB) 990. Ultimately, following the signing of the 2010 AOC, sample radionuclide concentrations would be compared to local background.

Another original intent was that EPA would follow MARSSIM guidelines. USEPA was, after all, a co-author of MARSSIM. USEPA did classify all buildings and sites as Class 1, 2 or 3 as required by MARSSIM, but that is as far as it went. The rationale for choosing Class 1 was based on physical proximity to former nuclear facilities, not based on MARSSIM guidelines of actual, or probability of exceeding DCGLs.¹⁶ Building 4038 served as the DOE/Boeing administrative offices, for 40 years, from 1964 to 2005. The author had his office in 4038 for seven years from 1998 to 2005. Building 4038 and its proximate area, were classified as Class 1, based on the following rationale.

- *"The preliminary MARSSIM Classification for the Building 4038 area is Class 1, due to its location within ETEC, and because the open storage area held activation products from Building 4059."*¹⁷

¹⁵ DOE Press Release, "DOE and EPA Sign Interagency Agreement to Study Area IV of Santa Susana Field Laboratory", July 24, 2008. Available at https://www.philrutherford.com/SSFL/EPA/DOE_EPA_AGREE_2008-07-24.pdf. Accessed January 19, 2022.

¹⁶ DCGL = derived concentration guideline level (exceeding background)

¹⁷ EPA, "Final Technical Memorandum, Subarea HSA-5C, Historical Site Assessment, SSFL, Area IV Radiological Study", October 2021. Available at https://www.etec.energy.gov/Library/Cleanup_and_Characterization/Soil/HSA/Volume%20IV%20HSA-5C.pdf#page=38. Accessed January 19, 2022.



The open storage area at 4059 refers to temporary storage during 2004 removal of saw-cut, sub-surface, activated concrete reactor cell walls.¹⁸ Area air monitoring at the time did not detect airborne contamination exceeding environmental standards.

MARSSIM recommends statistical methods of selecting the number of samples per survey unit to be taken, in order to be able to reject the null hypothesis that a survey unit remains contaminated (if appropriate). EPA did not do this.

MARSSIM further recommends several non-parametric statistical tests to compare survey units to referenced background, including the Wilcoxon Rank Sum test and the Sign Test. Both these tests compare the survey unit distribution to the referenced background distribution, to determine if the survey unit exceeds background, or not. EPA did not do this. Indeed the 2010 AOC requirement to compare each individual sample to a parametrically derived background metric (look-up table value (LUT)) violated the whole MARSSIM protocol and foundation.

EPA contracted with Hydrogeologic Inc. and the Palladino Company to conduct the survey. Detailed plans and interim and final reports are provided on the DOE ETEC web site.¹⁹ The principal work plans are provided here.

- Hydrogeologic Inc., [Final Gamma Radiation Scanning Sampling and Analysis Plan](#), February 2010. DOE Source.
- Hydrogeologic Inc., [Geophysical Investigation Plan](#), August 5, 2010. DOE Source.
- Hydrogeologic Inc., [Final Field Sampling Plan for Soil Sampling](#), March 5, 2012. DOE Source.

The principal results are provided here.

- Hydrogeologic Inc., [Final Gamma Radiation Scanning Report](#), October 17, 2012. DOE Source.
- Hydrogeologic Inc., [Final Geophysical Investigation Report](#), December 2, 2011. DOE Source.
- Hydrogeologic., [Final Radiological Characterization of Soil - Area IV and the Northern Buffer Zone](#), December 21, 2012. DOE Source.

A summary factsheet of results was published by the EPA in November 2012.

¹⁸ Boeing, "Radiological Remediation at the Department of Energy's Energy Technology Engineering Center", HPS Conference Paper, Spokane Washington, July 10-14, 2005. Available at https://www.etc.energy.gov/Library/Main/HPS_Radiological_Briefing_07-14-2005_Rev2.pdf. Accessed January 19, 2022.

¹⁹ DOE. "Clean-up at the Santa Susana Field Laboratory for DOE's Responsibility in Area IV - EPA Characterization." Available at https://www.etc.energy.gov/Char_Cleanup/EPA_Soil_Char.php. Accessed January 19, 2022.



- EPA, [Santa Susana Field Laboratory - EPA Radiological Characterization Study Results](#), November 2012. Boeing Source.

The EPA stated in its published reports ...

- *"EPA received \$41.5 million of DOE and Recovery Act Funds from the Federal government to conduct one of the most robust technical investigations ever undertaken for low-level radioactive contamination."*²⁰
- *"In general, EPA found elevated radiation levels in the areas where we expected to find them, isolated to a number of former process or disposal areas."*²¹
- *"... level of gamma radiation throughout most of the Area IV Study Area was lower than that of the RBRAs [Radiological Background Reference Areas]."*²²
- *"This survey resulted in the discovery of several areas of elevated radiation levels, but none of the levels recorded posed a health and safety danger to personnel as defined in the project Safety and Health Plan."*²³

HGL assigned personal dosimeters to all its employees and contractors during the period of the Area IV Survey. There were no reports of elevated exposures during the 3 ½ year field work.

Out of 3,735 soil and sediment samples and over 128,000 separate radiological analyses ...

- 423 (11%) samples exceeded the EPA background levels for man-made radionuclides.
- Only 8 (0.2%) samples exceeded the former DOE and State approved dose-based cleanup standard for conservative residential land use (only cesium-137).
- No results exceeded the EPA acceptable risk range for open space, recreational land use.

²⁰ EPA, "Santa Susana Field Laboratory - EPA Radiological Characterization Study Results", Page 1. November 2012. Available at http://www.boeing.com/resources/boeingdotcom/principles/environment/pdf/EPA_November_2012_Factsheet.pdf. Accessed January 19, 2022.

²¹ EPA Factsheet, "EPA Radiation Investigation Update", page 3, May 2012. Available at https://www.philrutherford.com/SSFL/EPA/EPA_May_2012_Factsheet.pdf#page=3. Accessed January 19, 2022.

²² EPA, Final Gamma Radiation Scanning Report, Area IV Radiological Study, SSFL", page 7.1, October 17, 2012. Available at https://www.etec.energy.gov/Library/Cleanup_and_Characterization/Soil/Co-Located/2_Final%20Gamma%20Radiation%20Scanning%20Report%20101712.pdf#page=78. Accessed January 19, 2022.

²³ EPA, Final Gamma Radiation Scanning Report, Area IV Radiological Study, SSFL", page 6.1, October 17, 2012. Available at https://www.etec.energy.gov/Library/Cleanup_and_Characterization/Soil/Co-Located/2_Final%20Gamma%20Radiation%20Scanning%20Report%20101712.pdf#page=70. Accessed January 19, 2022.



Prior radiological remediation had been based on meeting DOE and State approved cleanup soil cleanup standards.²⁴ The few samples exceeding the DOE and State approved cleanup standards demonstrate that prior remediation has been very effective in eliminating widespread contamination.

EPA conducted numerous public meetings and on-site tours to inform the public of the progress and ultimate results of the survey.

In the years following the EPA survey, DTSC reported the results in public meetings. A selection of DTSC's slides is shown below.

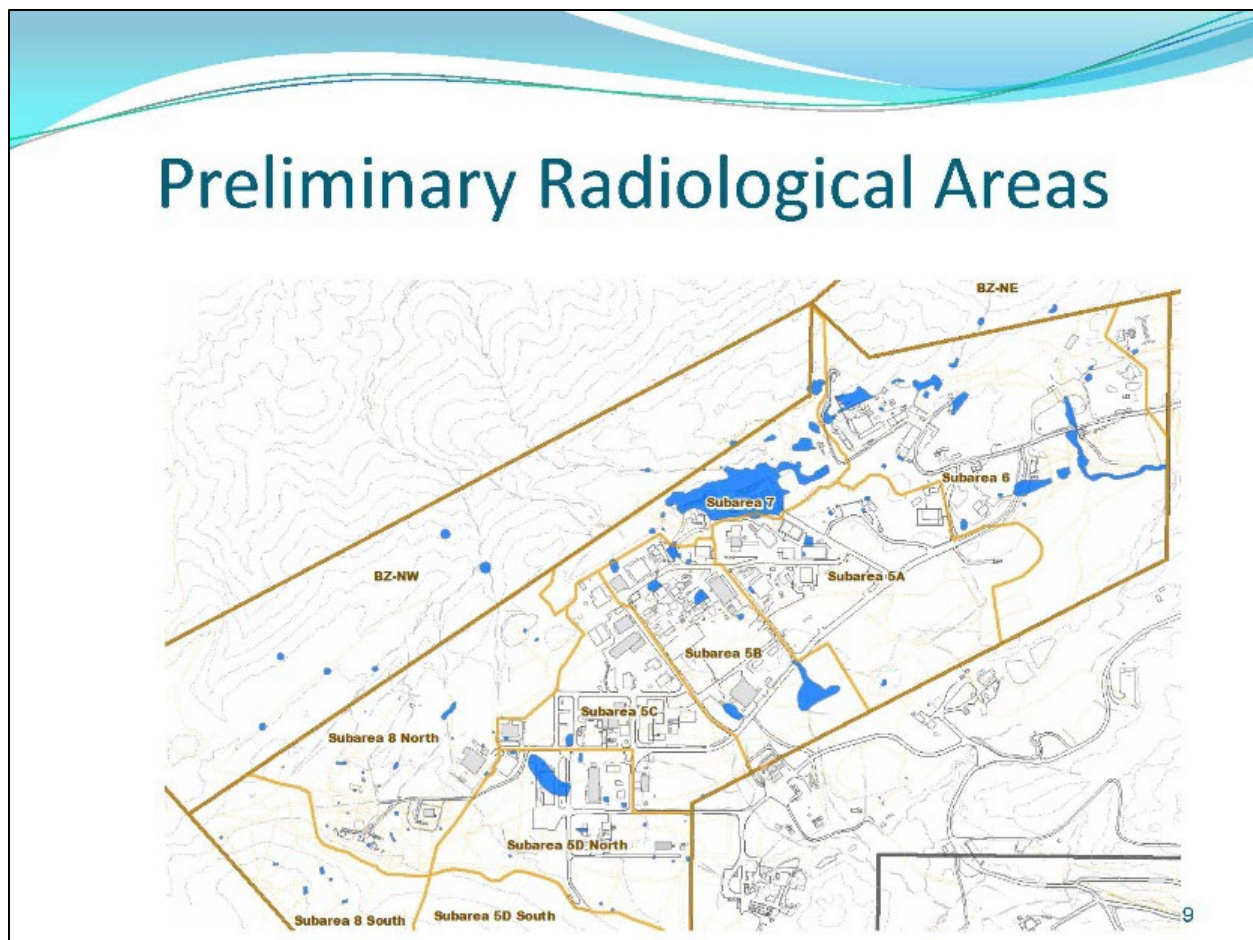


Figure 5. Areas Exceeding Radiological Background (LUT Values)
Extracted from [Community Update Meeting, November 13, 2014](#). DTSC Source.

²⁴ Boeing, "Approved Sitewide Release Criteria for Remediation of Radiological Facilities at the SSFL", February 18, 1999. Available at https://www.etec.energy.gov/Library/Main/Doc_No_26_Approved_Release_Criteria_for_Remediation_of_SSFL_RAD_Facilities%20.pdf. Accessed September 25, 2022.

Preliminary Remediation Areas- Chemicals

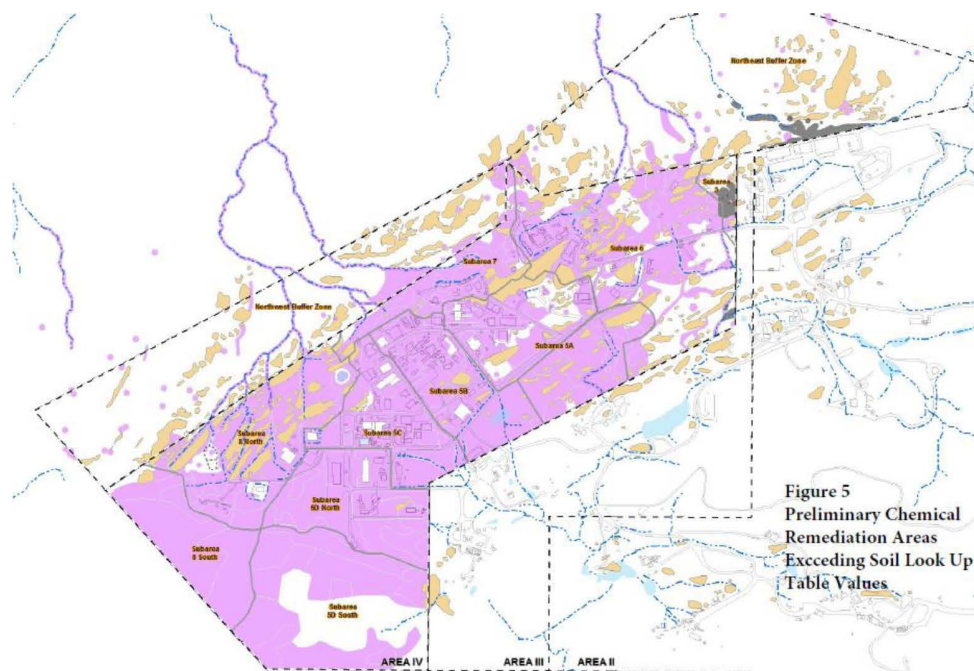


Figure 6. Areas Exceeding Chemical Background (LUT Values)

Extracted from [Community Update Meeting, November 13, 2014](#). DTSC Source.

Comparing the above two maps one can clearly see that using the ultra-conservative background criterion required by the 2010 AOC, radiological contamination is sparse, scattered and localized compared to the more widespread chemical contamination in Area IV.

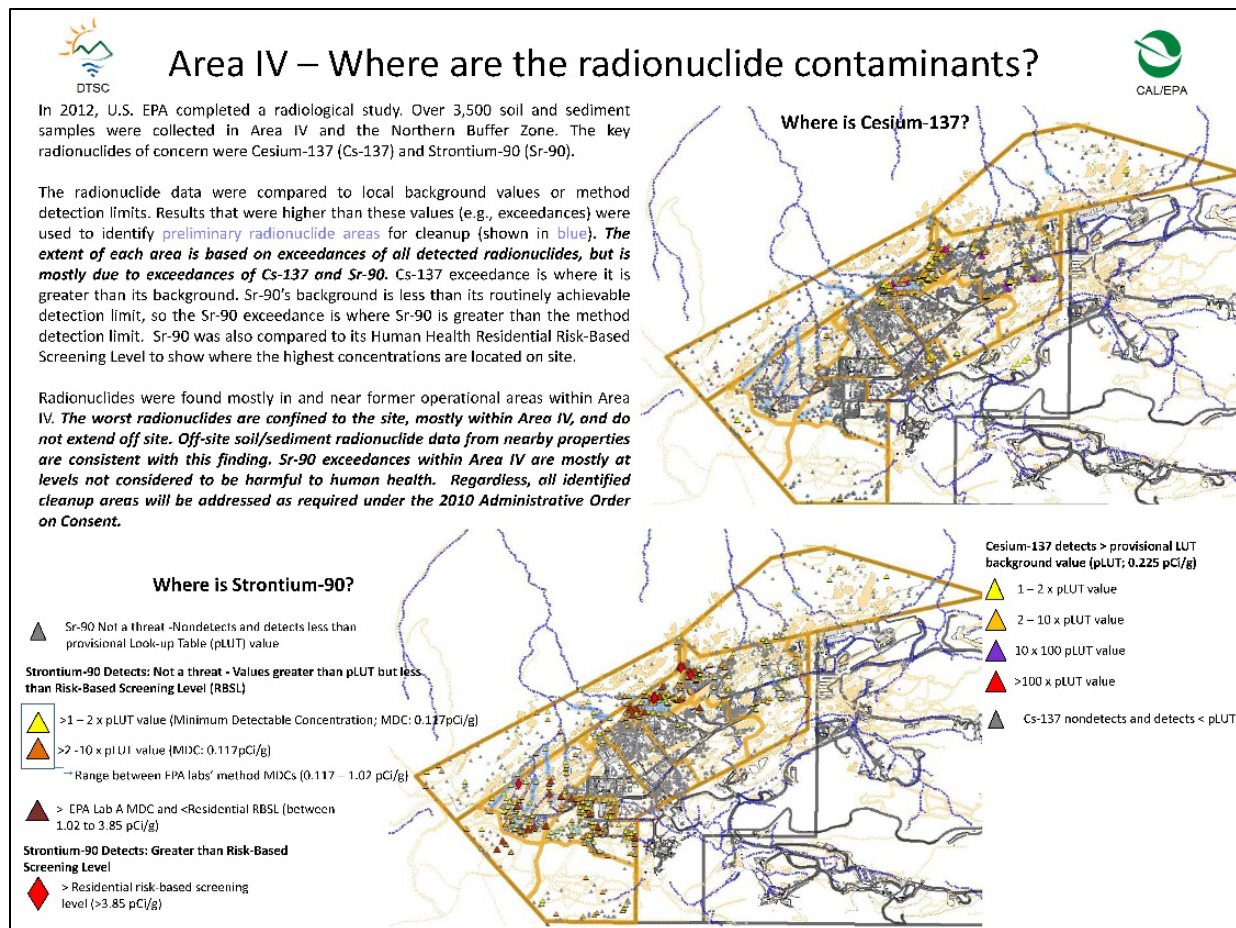


Figure 7. Area IV - Where are the Radionuclide Contaminants?
Extracted from [Bi-annual DTSC Public Meeting, April 2016](#). DTSC Source.

The dominant radionuclide contaminants were the fission products, cesium-137 and strontium-90, both with half-lives of approximately 30 years. The above map shows the great preponderance of soil sample results less than background (the draft provisional LUT). Only 291 of 3,735 (7.8%) samples exceeded the cesium-137 background threshold value (BTV) of 0.193 pCi/g. Only 153 of 3,735 (4.1%) samples exceeded the strontium-90 background threshold value (BTV) of 0.075 pCi/g.

5.4 EPA Radiological Background Study (2009-2011)

As a precursor to the EPA Radiological Characterization Survey of Area IV (discussed above), EPA conducted a background study to establish representative background values of 56 radionuclides.



Non-contaminated soil contains many primordial, naturally occurring radionuclides, including potassium-40, uranium isotopes, thorium isotopes and their numerous decay products including radium isotopes.

Anthropogenic (man-made) radionuclides were added to this mix during Trinity, Hiroshima, Nagasaki, the atmospheric nuclear weapons testing during the 1940s through 1960s, Chernobyl and Fukushima. These included the fission products, cesium-137 and strontium-90, neutron activation products such as cobalt-60, transuranic radionuclides such as plutonium-238 and plutonium-239, plus a myriad of other fission and activation products. These anthropogenic radionuclides are also considered part of background.

Since all these radionuclides are indigenous to soil, plants and crops grown in soil, contain these same radionuclides through uptake. In turn, farm animals and livestock, fed on grass and hay also contain these same radionuclides. To a lesser extent, fish ingest background radionuclides in the rivers and oceans. Finally, humans, at the end of the food chain, contain have all these same radionuclides in our bodies due to the food we eat.

Background radiation is discussed further.^{25,26}

The various plans and final reports for the EPA Background Study are provided on the DTSC SSFL website. Principal plans are ...

- Hydrogeologic Inc., [Final Sampling and Analysis Plan - Radiological Background Study - Santa Susana Field Laboratory, Ventura County, California](#), August 2009. DTSC Source.
- Hydrogeologic Inc., [Final Field Sampling Plan - Radiological Background Study - Santa Susana Field Laboratory, Ventura County, California](#), August 2009. DTSC Source.
- Hydrogeologic Inc., [Final Quality Assurance Project Plan - Radiological Background Study - Santa Susana Field Laboratory, Ventura County, California](#), August 2009. DTSC Source.

Principal results are reported in ...

- Hydrogeologic Inc., [Final Radiological Background Study Report - Santa Susana Field Laboratory, Ventura County, California](#), October 2001. DTSC Source.
- Hydrogeologic Inc., [Appendix A - Statistical Evaluations and Background Threshold Value Calculations](#), October 2011. DTSC Source.
- Singh, Anita, [Appendix B - Statistical Methodology](#), October 2011. DTSC Source.

²⁵ EPA, "Radiation Sources and Doses – Background Radiation." Available at <https://www.epa.gov/radiation/radiation-sources-and-doses>. Accessed September 20, 2022.

²⁶ Rutherford, "Potassium-40 in Food." Available at <https://philrutherford.com/perspectives/K-40.pdf>. Accessed September 20, 2022.



Overall, the EPA background study was a worthy accomplishment, though it was not without some criticisms. The influence of rainwater can preferentially concentrate surface deposited fallout radionuclides to higher-than-average levels, for instance, in drainage gullies, at roof driplines, at parking lot runoffs. EPA's choice of RBRA locations were only 3 individual 1-acre flat locations where no potential for drainage accumulation could occur.

There was considerable disagreement over the treatment of so-called non-detect data (ND). Laboratories reporting chemical results will report a result as <MDL if the result is less than the method detection limit (MDL). This is a non-quantitative result, or at best, a semi-quantitative result and is called left-censored, meaning there is no information to the left of MDL to indicate where the true value is, only that the value is not to the right of MDL. Accordingly procedures have been established to treat this data in both parametric statistics and non-parametric statistics. ProUCL, developed by Anita Singh of Lockheed for the EPA, is the software of choice for performing statistics on environmental data and uses the Kaplan-Meier method for handling chemical NDs. However, radionuclide data is reported by the laboratories with three numbers, measured value, $\pm 1.96\sigma$, MDA. The value is always quantitative even if the measured value is <MDA and even if <0. ProUCL and the Kaplan-Myer method was used by EPA for radionuclide data sets that included quantitative NDs. This censoring of quantitative data is believed to have biased the BTVs to the low side.

Establishment of background is the most important cornerstone in determining if media (in this case soil) has been contaminated by SSFL operations. If the cleanup standard (incremental to background) is significantly larger than background, then precision and accuracy in background is not very important. The DOE and State approved residential 15 mrem/y dose-based cleanup standard for cesium-137 was 9.2 pCi/g (net).²⁷ The NRC/EPA MOU for NRC licensed nuclear plants under EPA's CERCLA authority for cesium-37 is 6 pCi/g (net) ... not so very different.²⁸ In both cases a cesium-137 background of ~0.2 pCi/g is not very significant, Indeed one could perform dose and risk calculations using gross soil measurements without the need for background subtraction, and still achieve a result that is only conservative by 2-3 % of the true value.

This simple situation changes drastically when more restrictive cleanup standards are used. The current EPA 10^{-6} residential, 100% garden produce consumption, PRG for cesium-137 is 0.089

²⁷ Boeing, "Approved Sitewide Release Criteria for Remediation of Radiological Facilities at the SSFL", February 18, 1999. Available at https://www.etec.energy.gov/Library/Main/Doc_No_26_Approved_Release_Criteria_for_Remediation_of_SSFL_RAD_Facilities%20.pdf. Accessed September 25, 2022.

²⁸ EPA, OSWER 9295.8-06a, "Distribution of Memorandum of Understanding between EPA and the Nuclear Regulatory Commission", October 9, 2002. Available at <https://nepis.epa.gov/Exe/ZyPDF.cgi/P100K3Z6.PDF?Dockkey=P100K3Z6.PDF>. Accessed November 3, 2022.



pCi/g (net). The gross PRG would therefore be $0.089 + 0.2$ (background) = 0.289 pCi/g (gross). For a zero-risk cleanup standard (2010 AOC), a modest change in background could have a major impact on the volume of soil excavated.

EPA used no less than 9 different statistical parameters for “background.” See Table 4. EPA made recommendations to DTSC regarding the establishment of look-up table (LUT) values to be used for DOE and NASA remediation based on the 2010 AOC background mandate.

- Hydrogeologic Inc., [Appendix K - Development and Use of Radionuclide Reference Concentrations](#), November 28, 2012. DTSC Source.
- Hydrogeologic Inc., [Appendix L - Background Threshold Value and Radionuclide Selection Rationale](#), November 28, 2012. DTSC Source.
- Hydrogeologic Inc., [Final Technical Memorandum Look-Up Table Recommendations](#), November 27, 2012. DTSC Source.

Then DTSC decided that it would make Boeing use a tenth parameter, the upper tolerance limit, UTL95/95, in the 2022 Settlement Agreement, because Boeing is using a risk-based cleanup rather than a background cleanup like DOE and NASA. The cesium-137 and strontium-90 parameters are given in Table 4 to illustrate the wide variation in upper bound parameters that can be calculated from a single set of background data.

Table 4. Background Parameters for Cesium-127 and Strontium-90

Abbr.	Name	Derivation	Value (pCi/g)	
			Cs-137	Sr-90
RTL	Radiological Trigger Level (Original)	$\text{Max}(\text{BTV} : 2\sigma \text{ UCL MDC}) + 1.645 \cdot U_M$ using Round 1 data	0.207	0.485
RTL	Radiological Trigger Level (Revised)	$\text{Max}(\text{BTV} : 2\sigma \text{ UCL MDC}) + 1.645 \cdot U_M$ using Round 1 data	0.225	0.645
USL95	95% Upper Simultaneous Limit	ProUCL	0.193	0.0750
BTV	Background Threshold Value	USL95	0.193	0.0750
FAL _A	Field Action Level (Lab. A)	$\text{Max}(\text{BTV} : 2\sigma \text{ UCL MDC})$	0.193	0.387
FAL _B	Field Action Level (Lab. B)	$\text{Max}(\text{BTV} : 2\sigma \text{ UCL MDC})$	0.193	0.0750
RRC _A	Radiological Reference Level (Lab. A)	$\text{Max}(\text{BTV} : 2\sigma \text{ UCL MDC}) + 1.645 \cdot U_M$ using full data set	0.225	1.02
RRC _B	Radiological Reference Level (Lab. B)	$\text{Max}(\text{BTV} : 2\sigma \text{ UCL MDC}) + 1.645 \cdot U_M$ using full data set	0.225	0.117
LUT	Look Up Table Value	$\text{Min}(\text{RRC}_A : \text{RRC}_B)$	0.225	0.117
UTL95-95	95% Upper Tolerance Limit with 95% Coverage	ProUCL	0.151	0.0554



The reader is forgiven if all this is unnecessarily confusing. It only goes to prove my point. The technical debate has become ... what is and what is not background ... when the debate should be ... what is safe and what is not safe?

I have covered the subject of background in such detail to illustrate that it is a gray area. Were an adequate variety of background locations chosen to ensure the true variability and range of background? I think not. Should non-detect data be censored? I think not. What single value upper bound value should be chosen to represent the upper bound of background?

5.5 Comparison to McLaren-Hart Background Data

Table 5 compares the background estimates from the McLaren-Hart study of 1994 (Section 8.5) to the EPA Background Study (Section 5.4). Cesium-137 data are very comparable, while EPA strontium-90 is somewhat lower than McLaren-Hart data.

Table 5. Comparison of McLaren-Hart and EPA Background

Radionuclide	McLaren-Hart (1994)*		EPA (2011)**	
	Average (pCi/g)	Upper bound UCL95 (pCi/g)	Average (pCi/g)	Upper bound USL95 (pCi/g)
Cesium-137	0.087	0.21	0.0897	0.193
Strontium-90	0.052	0.11	0.0271	0.075
* https://www.etec.energy.gov/Environmental_and_Health/Documents/BrandeisBardin/AddSoilandWaterSamp.pdf . Table 20				
** https://www.dtsc-ssfl.com/files/lib_doe_area_iv/bgstudy/Final_SSFL_Radiological_Background_Study_Report-AppendixA.pdf . PDF pages 140 and 487				



6.0 HISTORICAL SITE ASSESSMENTS OF AREA IV

A prerequisite for any characterization survey or final status survey by a third party is to perform a “Historical Site Assessment” or HSA.

6.1 Sapere HSA (2005)

The 2005 DOE-sponsored Historical Site Assessment (HSA) was conducted to summarize the operational history of Area IV of the Santa Susana Field Laboratory from a radiological perspective. This activity was undertaken to identify areas of radiological operations, to compile prior radiological cleanups and agency releases, and to identify further actions needed to ensure that the radiological cleanup of Area IV is completed.

[Sapere Consulting](#) performed the HSA for the DOE. Boeing provided historical and current records to Sapere and provided a detailed peer review of the draft HSA.

- Sapere, Historical Site Assessment of Area IV, May 2005
- [Factsheet](#). DOE Source.
- [Volume 1 - Methodology](#). DOE Source.
 - [Figure 2-2 - Historical Location of Sites](#). Author Source.
 - [Figure 4-1 - Impacted and Non-Impacted Sites](#). Author Source.
 - [Figure 4-2 - Remaining Soil Surveys](#). Author Source.
- [Volume 2 - Site Summaries](#). DOE Source.

6.2 EPA HSA (2012)

The first step in conducting a Radiological Survey is to perform a Historical Site Assessment to assess the quantity and extent of contaminants on the site. If a third party is conducting the HSA, a records review is performed of the subject facility. Prior to the commencement of EPA’s HSA, the EPA served Boeing and the DOE with a CERCLA Section 104(e) information request.

- Letter from Katherine Moore (EPA) to W. James McNerney (Boeing), [Request for Information Pursuant to CERCLA Section 104\(e\); Santa Susana Field Laboratory, Ventura County, California](#), June 24, 2009. DTSC Source.
- Letter from Katherine Moore (EPA) to Melanie Pearson (DOE), [Request for Information Pursuant to CERCLA Section 104\(e\); Santa Susana Field Laboratory, Ventura County, California](#), June 24, 2009. DTSC Source.

Boeing and DOE responded within a 60-day period toward the end of August 2009.



- Letter from Tom Gallacher (Boeing) to Andrew Taylor (EPA), [Request for Information Pursuant to CERCLA Section 104\(e\): Santa Susana Field Laboratory, Ventura County, California](#), August 20, 2009. DTSC Source.
- Letter from Simon Lipstein (DOE) to Andrew Taylor (EPA), [Request for Information Pursuant to CERCLA 104\(E\) Santa Susana Field Laboratory, Ventura County, California](#), August 31, 2009. DTSC Source.

The initial digital document submittal to EPA by Boeing was via hard drive, comprising 84,194 files and 265 GB of data.

Subsequently, the following year, EPA requested from Boeing and DOE as-built building engineering drawings.

- Letter from Katherine Moore (EPA) to W. James McNerney (Boeing), [Supplemental Request for Information Pursuant of CERCLA Section 104\(e\) Santa Susana Field Laboratory, Ventura County, California](#), June 13 2010. DTSC Source.
- Letter from Katherine Moore (EPA) to Melanie Pearson Hurley (DOE), [Supplemental Request for Information Pursuant of CERCLA Section 104\(e\) Santa Susana Field Laboratory, Ventura County, California](#), June 17 2010. DTSC Source.

Boeing and DOE responded,

- Letter from Tom Gallacher (Boeing) to Andrew Taylor (EPA), [The Boeing Company's \(Boeing\) Second Supplemental Response to U.S. EPA Supplemental Request for Information Pursuant of CERCLA Section 104\(e\): Santa Susana Field Laboratory, Ventura County, California, June 17 2010 \(Supplemental Request\)](#), July 15, 2010. DTSC Source.
- Letter from Simon Lipstein (DOE) to Andrew Taylor (EPA), [Request for Information Pursuant of CERCLA Section 104\(e\): Santa Susana Field Laboratory, Ventura County, California Dated June 24, 2009](#), July 30, 2010. DTSC Source.

Subsequently EPA requested additional information from Boeing including, licensing documents, deposition transcripts, and key-word searches of the 2007 Consent Order Historical Document Database for each and every building in Area IV. In total, Boeing provided to EPA, 200,522 digital document records totaling 584 GB of data. DTSC and DOE were also provided these same records, contemporaneously.

During the next 3 years, Hydrogeologic Inc. reviewed these records and incorporated information obtained from interviews with some 181 employees and ex-employees to generate the Area IV Historical Site Assessment. This information was used during the document review and HSA preparation to guide the field work of the EPA Radiological Survey.

In October 2012, the EPA issued the final HSA, essentially coincident with the completion of the Radiological Survey.



- Hydrogeologic Inc., Final Historical Site Assessment, Santa Susana Field Laboratory Site, Area IV Radiological Study, Ventura County, California, October 2012. DOE Source.
 - Volume I Introduction.
 - Appendix A Aerial Photos.
 - Appendix B Employee Interviews.
 - Volume II: Subarea HSA-5A.
 - Volume III: Subarea HSA-5B.
 - Volume IV: Subarea HSA-5C.
 - Volume V: Subarea HSA-5D.
 - Volume VI: Subarea HSA-6.
 - Volume VII: Subarea HSA-7/3/NBZ.
 - Volume VIII: Subarea HSA-8.

The following is the preface to the HSA that discusses the reasons why some portions (<1%) of the HSA had been redacted and the way that US persons may view the unredacted version of the HSA at the Chatsworth office of the DTSC.

“In preparing this Historical Site Assessment (HSA) for the Santa Susana Field Laboratory Site Area IV Radiological Study, the U.S. Environmental Protection Agency (EPA) sought to provide the most comprehensive and far-reaching HSA possible. Among the voluminous amount of documents reviewed and ultimately used in preparing the HSA, several documents were used that have been identified as containing information potentially restricted by U.S. export control laws, including the Arms Export Control Act (22 U.S.C. section 2751 et seq.), the International Traffic in Arms Regulations (22 C.F.R. Part 120), the U.S. Department of Commerce’s Export Administration Regulations (15 C.F.R. Parts 730-774), and the U.S. Department of Energy’s Foreign Atomic Energy Activities Regulations (10 C.F.R. Part 810). These documents may only be reviewed by U.S. persons. U.S. persons are U.S. citizens, U.S. nationals, lawful permanent residents of the U.S., or persons who are protected individuals as defined by 8 U.S.C. section 1324(b)(a)(3) (certain refugees and grantees of asylum). Transfer of controlled information by any means to a non-U.S. person, whether in the U.S. or abroad, without a valid export license or prior written approval from the Department of State, Department of Commerce, or other relevant federal agency, is prohibited.”

“In order to provide the HSA to the broadest audience possible without encumbrances, EPA has chosen to prepare a redacted version of the HSA to comply with U.S. law. This means that certain passages within this version of the HSA containing information potentially restricted by U.S. export control laws have been made illegible in order to protect this sensitive information while maintaining the original flow and organization of the HSA. It should be noted that as a percentage of the total HSA, the passages that have been redacted comprise less than 1 percent of the HSA.”



“Per agreement with EPA’s interagency partner at the Santa Susana Field Laboratory Site, the California Department of Toxic Substances Control (DTSC), EPA has provided an unredacted version of this HSA, with all parts made legible, for public review should a member of the public wish to review the entire HSA. Members of the general public who wish to review the entire HSA without redactions should contact the DTSC and make an appointment to do so. At the time of the appointment, DTSC will verify whether the individual requesting the review is a U.S. person and only U.S. persons will be permitted to read the passages that have been redacted. However, the information presented in those passages will remain under the purview of U.S. export control laws and cannot be removed from the DTSC office or copied or transmitted in any form.”

“To make arrangements to review the full version of the HSA report, including information restricted under the export control laws of the U.S., members of the public should contact the following DTSC office:”

*California Department of Toxic Substances Control
9211 Oakdale Avenue Chatsworth, CA 91311
Phone: (818) 717-6500*

6.3 Radionuclides Related to Historical Operations at SSFL Area IV

DOE commissioned Dr. Thomas Rucker of SAIC to conduct a theoretical assessment of what radionuclides might still be present in significant quantities at Area IV, SSFL, based on existing knowledge of nuclear operations, production rates of by-product material, and known radioactive decay rates. The assessment was not based on sampling data of environmental media. It was recognized that the information would ensure that all significant contributors to risk are included in future risk assessments, and to help prioritize analytical requirements or new samples to be collected for pending studies. Dr. Rucker issued his report in March 2009.

- Rucker, Thomas. [Radionuclides Related to Historical Operations at the Santa Susana Field Laboratory Area IV](#). March 2009. DOE Source



7.0 ONSITE MEDIA SAMPLING

As a key part of the nuclear decommissioning process for nuclear and radiological facilities, the footprints and surrounds of these facilities were surveyed and sampled. The reader is referred to the companion report to view soil sample data.

- Rutherford, [Nuclear Decommissioning at the Santa Susana Field Laboratory](#), Section 2.0 and Table 2. Author Source

[Section 5.0](#) of this report presents the results of a series of Area IV-wide sampling programs culminating in the 2008-2012 EPA Radiological Characterization Survey.

7.1 ETEC Annual Site Environmental Monitoring Reports (1955-2019)

For the last seven decades, Boeing, its predecessor companies, and since 2014, North Wind, have published annual site environmental monitoring reports (ASERs) that document both onsite and offsite radiological (and recently chemical) environmental monitoring at SSFL and other legacy AI facilities in Canoga Park.

The most recent 2019 ASER, issued by North Wind reiterated the conclusions of prior ASERs that,

- *“Results of the radiological monitoring program continue to indicate that there were no significant releases of radioactive material from Area IV of SSFL. All potential exposure pathways were sampled and/or monitored, including air, soil, surface water, groundwater, direct radiation, transfer of property (land, structures, waste), and recycling.”*

The following list of URLs is copied directly from the DOE ETEC website.²⁹

- [2022 Site Environmental Report](#). Department of Energy, Energy Technology Engineering Center – Area IV Santa Susana Field Laboratory, October, 2023
- [2021 Site Environmental Report](#), Department of Energy, Energy Technology Engineering Center - Area IV Santa Susana Field Laboratory, November, 2022
- [2019 Site Environmental Report](#), Department of Energy, Energy Technology Engineering Center – Area IV Santa Susana Field Laboratory, January, 2021
- [2018 Site Environmental Report](#). Department of Energy, Energy Technology Engineering Center – Area IV Santa Susana Field Laboratory, April 2019

²⁹ DOE/ETEC, “Annual Site Environmental Monitoring Report (ASER).” Available at https://www.etec.energy.gov/Environmental_and_Health/ASER.php. Accessed February 23, 2024.



- 2017 Site Environmental Report. Department of Energy, Energy Technology Engineering Center – Area IV Santa Susana Field Laboratory March, 2018
- 2016 Site Environmental Report. Department of Energy, Energy Technology Engineering Center – Area IV Santa Susana Field Laboratory March, 2017
- 2015 Site Environmental Report. Department of Energy, Energy Technology Engineering Center – Area IV Santa Susana Field Laboratory June, 2016
- 2014 Site Environmental Report. Department of Energy Operations at the Energy Technology Engineering Center - Area IV Santa Susana Field Laboratory May 2015
- 2013 Site Environmental Report. DOE Operations at The Boeing Company. Santa Susana Field Laboratory. Area IV. June 2014
- 2012 Site Environmental Report. DOE Operations at The Boeing Company. Santa Susana Field Laboratory. Area IV. September 2013
- 2011 Site Environmental Report. DOE Operations at The Boeing Company. Santa Susana Field Laboratory. Area IV. September 2012
- 2010 Site Environmental Report. DOE Operations at The Boeing Company. Santa Susana Field Laboratory. Area IV. September 2011
- 2009 Site Environmental Report. DOE Operations at The Boeing Company. Santa Susana Field Laboratory. Area IV. September 2010
- 2008 Site Environmental Report. DOE Operations at The Boeing Company. Santa Susana Field Laboratory. Area IV. September 2009
- 2007 Site Environmental Report. DOE Operations at The Boeing Company. Santa Susana Field Laboratory. Area IV. September 2008
- 2006 Site Environmental Report. DOE Operations at The Boeing Company. Santa Susana Field Laboratory. Area IV. September 2007
- 2005 Site Environmental Report. DOE Operations at The Boeing Company. Santa Susana Field Laboratory. September 2006.
- 2004 Site Environmental Report. DOE Operations at The Boeing Company. Santa Susana Field Laboratory. RD05-176. September 2005.
- 2003 Site Environmental Report. DOE Operations at The Boeing Company. Santa Susana Field Laboratory. RD04-170. September 2004.
- 2002 Site Environmental Report. DOE Operations at The Boeing Company. Santa Susana Field Laboratory. RD02-148-01. September 2003.
- 2001 Site Environmental Report. DOE Operations at The Boeing Company. Santa Susana Field Laboratory. RD02-148. September 2002.
- 2000 Site Environmental Report. DOE Operations at The Boeing Company. Santa Susana Field Laboratory. RD01-152. September 2001.
- 1999 Site Environmental Report. DOE Operations at The Boeing Company, Rocketdyne. RD00-159. September 2000.
- 1998 Site Environmental Report. Santa Susana Field Laboratory. DOE Operations. RD99-115. September 22, 1999
- 1997 Annual Site Environmental Report. Santa Susana Field Laboratory. DOE Operations. A4CM-ZR-0012. November 23, 1998



- 1996 Annual Site Environmental Report. Santa Susana Field Laboratory. DOE Operations. RD97-134. November 10, 1997
- 1995 Annual Site Environmental Report. Rocketdyne Division. Santa Susana Field Laboratory and De Soto Sites. RI/RD96-140. July 30, 1996
- 1994 Annual Site Environmental Report. Rocketdyne Division. Santa Susana Field Laboratory and De Soto Sites. RI/RD95-153. September 30, 1995
- 1993 Annual Site Environmental Report. Rocketdyne Division. Santa Susana Field Laboratory and De Soto Sites. RI/RD94-126. October 21, 1994
- 1992 Annual Site Environmental Report. Rocketdyne Division. Santa Susana Field Laboratory and De Soto Sites. RI/RD93-125. Revision A. December 14, 1993
- 1991 Annual Site Environmental Report. Rocketdyne Division. Santa Susana Field Laboratory and De Soto Sites. RI/RD92-138. September 30, 1992
- 1990 Environmental Monitoring Annual Report. Rocketdyne Division. Santa Susana Field Laboratory, De Soto and Canoga Sites. RI/RD91-136. June 20, 1991
- 1989 Environmental Monitoring and Facility Effluent Annual Report. Rocketdyne Division. De Soto and Santa Susana Field Laboratories Sites. RI/RD90-132. May, 1990
- 1988 Environmental Monitoring and Facility Effluent Annual Report. Rocketdyne Division. De Soto and Santa Susana Field Laboratory Sites. RI/RD89-139. May, 1989
- 1987 Environmental Monitoring and Facility Effluent Annual Report. Rocketdyne Division. De Soto and Santa Susana Field Laboratory Sites. RI/RD88-144. March, 1988
- 1986 Environmental Monitoring and Facility Effluent Annual Report. Rocketdyne Division. De Soto and Santa Susana Field Laboratory Sites. RI/RD87-133. March, 1987
- 1985 Environmental Monitoring and Facility Effluent Annual Report. Rocketdyne Division. De Soto and Santa Susana Field Laboratory Sites. RI/RD86-140. April, 1986
- 1984 Environmental Monitoring and Facility Effluent Annual Report. Rocketdyne Division. De Soto and Santa Susana Field Laboratory Sites. RI/RD85-123. March, 1985
- 1983 Environmental Monitoring and Facility Effluent Annual Report. Energy Systems Group. ESG-84-9. March, 1984
- 1982 Environmental Monitoring and Facility Effluent Annual Report. Energy Systems Group. ESG-83-17. June, 1983
- 1981 Environmental Monitoring and Facility Effluent Annual Report. Energy Systems Group. ESG-82-21. July 15, 1982
- 1980 Environmental Monitoring and Facility Effluent Annual Report. Energy Systems Group. ESG-81-17. May 27, 1981
- 1979 Environmental Monitoring and Facility Effluent Annual Report. Energy Systems Group. ESG-80-7. April 25, 1980
- 1978 Environmental Monitoring and Facility Effluent Annual Report. Energy Systems Group. ESG-79-7. April, 1979
- 1977 Environmental Monitoring and Facility Effluent Annual Report. Atomics International. AI-78-16. April, 1978
- 1976 Environmental Monitoring and Facility Effluent Annual Report. Atomics International. AI-77-14. 1977



- 1975 Environmental Monitoring and Facility Effluent Annual Report. Atomics International. AI-76-14. 1976
- 1974 Environmental Monitoring and Facility Effluent Annual Report. Atomics International. AI-75-31. 1975
- 1973 Environmental and Radioactive Effluent Monitoring. Annual Report. Atomics International.
- 1972 Environmental Monitoring. Annual Report. Atomics International.
- 1972 Annual Report Addendum.
- 1972 Annual Report Revision.
- 1971 Environmental Monitoring. Semiannual Report. (July 1, 1971 to December 31, 1971) and Annual Report. Atomics International.
- 1971 Environmental Monitoring. Semiannual Report. (January 1, 1971 to June 30, 1971) and Annual Report. Atomics International.
- 1970 Environmental Monitoring. Semiannual Report. (July 1, 1970 to December 31, 1970) and Annual Report. Atomics International.
- 1970 Environmental Monitoring. Semiannual Report. (January 1, 1970 to June 30, 1970). Atomics International.
- 1969 Environmental Monitoring. Semiannual Report. (July 1, 1969 to December 31, 1969) and Annual Report. Atomics International.
- 1969 Environmental Monitoring. Semiannual Report. (January 1, 1969 to June 30, 1969). Atomics International.
- 1968 Environmental Monitoring. Semiannual Report. (July 1, 1968 to December 31, 1968) and Annual Report. Atomics International.
- 1968 Environmental Monitoring. Semiannual Report. (January 1, 1968 to June 30, 1968). Atomics International.
- 1967 Environmental Monitoring. Semiannual Report. (July 1, 1967 to December 31, 1967) and Annual Report. Atomics International.
- 1967 Environmental Monitoring. Semiannual Report. (January 1, 1967 to June 30, 1967). Atomics International.
- 1966 Environmental Monitoring. Semiannual Report. (July 1, 1966 to December 31, 1966) and Annual Report. Atomics International.
- 1966 Environmental Monitoring. Semiannual Report. (January 1, 1966 to June 30, 1966). Atomics International.
- 1965 Environmental Monitoring. Semiannual Report. (July 1, 1965 to December 31, 1965) and Annual Report. Atomics International.
- 1965 Environmental Monitoring. Semiannual Report. (January 1, 1965 to June 30, 1965). Atomics International.
- 1964 Environmental Monitoring. Semiannual Report. (July 1, 1964 to December 31, 1964) and Annual Report. Atomics International.
- 1964 Environmental Monitoring. Semiannual Report. (January 1, 1964 to June 30, 1964). Atomics International.



- 1963 Environmental Monitoring. Semiannual Report. (July 1, 1963 to December 31, 1963) and Annual Report. Atomics International.
- 1963 Environmental Monitoring. Semiannual Report. (January 1, 1963 to June 30, 1963). Atomics International.
- 1962 Environmental Monitoring. Semiannual Report. (July 1, 1962 to December 31, 1962) and Annual Report. Atomics International.
- 1962 Environmental Monitoring. Semiannual Report. (January 1, 1962 to June 30, 1962). Atomics International. NAA-SR-7650.
- 1961 Environmental Monitoring Report. Annual Summary. Atomics International
- 1961 Environmental Monitoring Report. (October 1, 1961 to December 31, 1961). Atomics International
- 1961 Environmental Monitoring Report. (July 1, 1961 to September 30, 1961). Atomics International
- 1961 Environmental Monitoring Report. (April 1, 1961 to June 30, 1961). Atomics International
- 1961 Environmental Monitoring Report. (January 1, 1961 to March 31, 1961). Atomics International
- 1960 Environmental Monitoring Report. Annual Summary. Atomics International
- 1960 Environmental Monitoring Report. (October 1, 1960 to December 31, 1960). Atomics International
- 1960 Environmental Monitoring Report. (April 1, 1960 to June 30, 1960). Atomics International
- 1959 Environmental Monitoring Annual Report. Atomics International. AI-Memo-5427. June 24, 1960
- 1956 Environmental Surveys. 3rd Quarter Progress Report. November 15, 1956
- 1956 Environmental Surveys. 2nd Quarter Progress Report. August 7, 1956
- 1956 Environmental Surveys. 1st Quarter Progress Report. May 8, 1956
- 1955 Environmental Surveys. 4th Quarter Progress Report. March 26, 1956

7.2 ETEC NESHAPS Effluent Monitoring Reports (1992-2017)

National Emission Standards for Hazardous Air Pollutants (NESHAPS) Reports for the Department of Energy's (DOE) facilities at the Santa Susana Field Laboratory (SSFL) are provided below from 1991 to 2016.

The U.S. Environmental Protection Agency (EPA) regulates airborne releases of radioactivity from DOE facilities under 40 CFR 61, Subpart H. These NESHAPS reports document the radionuclide analysis results of the effluent samples from all applicable emission sources. They also include the off-site dose assessment results, which are compared against the EPA



standards of 10 mrem/y for compliance demonstration. The following list of URLs is copied directly from the DOE ETEC website.³⁰

- 2016 NESHAPs Report for DOE Operations in Area IV, SSFL. March 20, 2017
- 2015 NESHAPs Report for DOE Operations in Area IV, SSFL. March 23, 2016
- 2014 NESHAPs Report for DOE Operations in Area IV, SSFL. March 2, 2015
- 2013 NESHAPs Report for DOE Operations in Area IV, SSFL. March 14, 2014
- 2012 NESHAPs Report for DOE Operations in Area IV, SSFL. May 22, 2013
- 2011 NESHAPs Report for DOE Operations in Area IV, SSFL. May 15, 2012
- 2010 NESHAPs Report for DOE Operations in Area IV, SSFL. May 26, 2011
- 2009 NESHAPs Report for DOE Operations in Area IV, SSFL. May 20, 2010
- 2008 NESHAPs Report for DOE Operations in Area IV, SSFL. June 24, 2009
- 2007 NESHAPs Report for DOE Operations in Area IV, SSFL. June 19, 2008
- 2006 NESHAPs Report for DOE Operations in Area IV, SSFL. June 13, 2007
- 2005 NESHAPs Report for DOE Operations in Area IV, SSFL. June 8, 2006
- 2004 NESHAPs Report for DOE Operations in Area IV, SSFL. June 14, 2005
- 2003 NESHAPs Report for DOE Operations in Area IV, SSFL. May 11, 2004
- 2002 NESHAPs Report for DOE Operations in Area IV, SSFL. June 2, 2003
- 2001 NESHAPs Report for DOE Operations in Area IV, SSFL. May 22, 2002
- 2000 NESHAPs Report for DOE Operations in Area IV, SSFL. June 7, 2001
- 1999 NESHAPs Report for DOE Operations in Area IV, SSFL. June 9, 2000
- 1998 NESHAPs Report for DOE Operations in Area IV, SSFL. May 27, 1999
- 1997 NESHAPs Report for DOE Operations in Area IV, SSFL. June 12, 1998
- 1996 NESHAPs Report for DOE Operations in Area IV, SSFL. June 4, 1997
- 1995 NESHAPs Report for DOE Operations in Area IV, SSFL. May 30, 1996
- 1994 NESHAPs Report for DOE Operations in Area IV, SSFL. June 16, 1995
- 1993 NESHAPs Report for DOE Operations in Area IV, SSFL. June 7, 1994
- 1992 NESHAPs Report for DOE Operations in Area IV, SSFL. May 21, 1993
- 1991 NESHAPs Report for DOE Operations in Area IV, SSFL. June 1, 1992

The 1991 NESHAPs report is noteworthy for its length. During the 1991 DOE Tiger Team audit, several findings were issued related to effluent sampling. These are addressed in detail in the 1991 NESHAPs report. In addition an “Independent Review Group on Radiological Assessment of Airborne Releases” was commissioned to review and assess effluent sampling systems at the Hot Lab., the RMDF and Building 4059.

- Independent Review Team, [Assessment of Airborne Radiological Releases at ETEC](#), April 4, 1991. Author Source.

³⁰ DOE/ETEC, “National Emission Standards for Hazardous Air Pollutants (Radionuclides)”,. Available at https://www.etec.energy.gov/Environmental_and_Health/NESHAPs.php. Accessed October 12, 2022.



The four-member group concluded,

- *"We see no indication that these operations at the site represent any significant release of radioactivity nor any threat to the surrounding environment and population."*

Finally, since the 2008 NESHAPS report, termination of all DOE decommissioning activities, termination of associated stack effluents and termination of all wide-area soil remediation activities, the offsite airborne dose has been declared to be zero millirem/y. NESHAPS reports were terminated by DOE after 2016.

7.3 RCRA Facility Investigation - Soil

DTSC maintains a comprehensive document library for the SSFL RCRA Facility Investigation program for soils at,

- DTSC, [Document Library](#). Click on RCRA Facility Investigation - Soils

Given that the RCRA soil and groundwater chemical characterization programs are probably the largest Boeing remediation programs in terms of expenditure and resources, it is puzzling why Boeing relies on DTSC to maintain the primary online technical document library for all Boeing documents, reports, and data. DOE maintains an extensive online document library for its activities in Area IV. Boeing Santa Susana should maintain its own document library similar to what it does for stormwater technical documents.

7.4 RCRA Facility Investigation - Groundwater

DTSC maintains a comprehensive document library of the RCRA Facility Investigation for groundwater at,

- DTSC, [Document Library](#). Click on RCRA Facility Investigation - Groundwater

7.5 Stormwater

Stormwater (aka surface water) is regulated by the Los Angeles Regional Water Quality Control Board (RWQCB). The RWQCB issued a National Pollution Discharge Elimination (NPDES) Permit to Boeing for SSFL including those areas with DOE and NASA remediation responsibilities.

The NPDES Permit specifies management, retention, treatment, sampling, and discharge requirements for storm/surface water prior to being allowed to flow from the site to southern discharge locations. In addition, the RWQCB imposes soil remediation requirements in outfall watersheds, referred to as Interim Source Removal Actions (ISRA).



Unlike the DTSC that maintains a voluminous document library on its website devoted to its areas of regulatory responsibility at SSFL, the RWQCB has no such facility. Therefore the RWQCB requires Boeing to maintain all NPDES and ISRA related documents, reports, and data on the Boeing Santa Susana website. This material is at the following Boeing source.

- [Santa Susana Stormwater Technical Library](#)
 - [NPDES Permit History](#)
 - [Monitoring Reports](#)
 - [Technical Reports](#)
 - [Expert Panel](#)
 - Human Health Risk Assessment (HHRA)
 - [Work Plan](#), March 31, 2016
 - [Final Human Health Risk Assessment](#), October 30, 2017
 - [RWQCB Letter of Receipt](#), November 20, 2017

Principal conclusions of the HHRA were,

- *"The results of this HHRA indicate that, potential recreational exposures to COPCs in surface water runoff exiting the SSFL via Outfalls 001, 002, 008, 009, 011, 018, and 019 are below levels of concern as established by Cal-EPA and USEPA. This includes those COPCs that have had NPDES permit limit exceedances such as lead and dioxins."*

7.5.1 Interim Source Removal Action

Although the RWQCB primarily regulates storm water effluent, when soil contamination in watershed areas could potentially impact water quality in NPDES permitted Outfalls, the RWQCB shares regulatory jurisdiction with the DTSC. Such areas were identified as requiring soil remediation as an "Interim Source Removal Action (ISRA)." Sampling for chemicals and radionuclides is done to (1) determine whether excavation is required, and (2) if excavation is required, what disposal options are appropriate?

- [Interim Source Removal Action \(ISRA\)](#). Boeing Source.

The ISRA action in NASA Area II, illustrates the complexity of moving goalposts during the 2008 to 2013 period, caused by the 2010 AOC and implementation of radionuclide and chemical LUTVs.

Pre 2010 AOC

Radionuclides were compared to the McLaren-Hart radionuclide background using the non-parametric Wilcoxon Rank Sum statistical test as recommended by DTSC and MARSSIM.

- Boeing, [Interim Source Removal Action Soil Management Plan](#), July 10, 2009. Boeing Source



- [Attachment A. ISRA Waste Sampling for Radionuclides](#). July 9, 2009. Boeing Source.
- Boeing, [2010 Addendum to the Interim Source Removal Action \(ISRA\) Soil Management Plan](#), May 2010. Boeing Source.
 - [Attachment A. ISRA Waste Sampling for Radionuclides](#), May 2010. Boeing Source.
 - Radionuclide sampling data for sample ISRA location, [ISRA 009 - AP/STP-1A](#). August 23, 2010. Boeing Source.

Post 2010 AOC

The concentrations of radionuclides determined the disposal options for the ISRA soil. Following the 2010 AOC, any soil exceeding RTLs (provided by EPA December 2011) was disposed of to the licensed LLRW EnergySolutions facility in Clive, Utah. Soil not exceeding radionuclide RTLs went to disposal sites determined by the levels of chemical contaminants.

- Example [ISRA 009 AP/STP-1B, --1C1, -1C2 and -1E2](#). September 27, 2012. Boeing Source

Following publication of draft provisional radionuclide LUT values in January 2013, any soil exceeding LUT values was disposed of to EnergySolutions. Soil not exceeding radionuclide LUT values went to disposal sites determined by the levels of chemical contaminants.

- Example, [ISRA 009, ELV-1C \(Non-Hazardous, Radionuclides >LUT\)](#), April 2, 2013. Author Source.
- Example, [ISRA 009, ELV-1C \(Cal-Hazardous, Radionuclides >LUT\)](#), April 2, 2013. Author Source.
- Example, [LOX \(Non-Hazardous, Radionuclides >LUT\)](#), June 6, 2013. Author Source.

7.6 Air Monitoring

Section 7.1 provides the results of airborne radionuclide monitoring that has been performed in Area IV from 1955 to the present day.

In 2016, plans began to be formulated for a SSFL-wide air monitoring program, implemented by Boeing, DOE, and NASA, and overseen by DTSC. Documentation (work plans, results and communications) for this program can be found at,

- DTSC, [Document Library](#). Click on Air Monitoring. DTSC Source.

Initial draft and final plans were,

- NASA, Boeing, DOE, [Draft Baseline Air Monitoring Work Plan, Santa Susana Field Laboratory, Ventura County, California](#), April 2016. DTSC Source.



- Cover Letter, Lenox (Boeing) to Malinowski (DTSC), [Draft Baseline Air Monitoring Work Plan, SSFL](#). April 18, 2016. DTSC Source
- NASA, Boeing, DOE, [Final Baseline Air Monitoring Work Plan, Santa Susana Field Laboratory, Ventura County, California](#), June 2017. DTSC Source.
 - Cover Letter, Zorba (NASA) to Malinowski (DTSC), [Santa Susana Field Laboratory Air Monitoring Work Plan](#). June 30, 2017. DTSC Source.
- NASA, Boeing, DOE, [Final Baseline Air Monitoring Work Plan, Santa Susana Field Laboratory, Ventura County, California](#). September 21, 2017. DTSC Source.

Initial air sampling began on April 15, 2018, for volatile organic compounds (VOCs). PM_{2.5}, PM₁₀ and radionuclides. The objective of the Baseline Air Monitoring program is to evaluate baseline (that is, pre-project) conditions and provide a basis for determining the magnitude of deviation from those baseline conditions resulting from onsite remediation activities (project) at SSFL.

Boeing operates six stations, two in Area I, and four in the southern undeveloped land.

NASA operates four stations, three in Area II and the NASA portion of Area I, and one in the northern undeveloped land.

DOE operates four stations on the perimeter of Area IV.

Locations are shown on [Figure 1](#) of,

- DTSC, Letter from Mark Malinowski to NASA, Boeing and DOE, [Approval of the Final Air Monitoring Station Locations for the Santa Susana Field Laboratory, Ventura County California](#). [Figure 1](#). January 30, 2018. DTSC Source.

Boeing, NASA, and DOE report results, separately each quarter and annually. All reports may be found on the [DTSC Document Library](#), Air Monitoring. The annual reports are provided in Table 6.

Table 6. Air Monitoring Annual Reports

Year	Boeing	DOE	NASA
4/15/2018 - 4/14/2019	X	X	X
4/15/2019 - 12/31/2019	X	X	X
2020	X	X	X
2021	X	X	X
2022	X	X	X

DOE's conclusions for its 2021 annual report included,³¹

³¹ During 2021, DOE demolished buildings 4019, 4024, 4038, 4057, 4462 and 4463.



- “Site activities during 2021Q4 included the demolition of buildings 4462/4463. Work area air monitoring was conducted during this building demolition, confirming **there was no airborne contamination resulting from the demolition activities.**”
- “When comparing 2021Q4 and the rest of the 2021 data, to 2018, 2019, and 2020 data, the PM10, VOC, and radionuclide data collected are consistent, indicating that **building demolition activities had no impact on the site air conditions.**”

DOE’s conclusions for its 2020 annual report included,³²

- “When comparing 2020Q4 and the rest of the 2020 data, to 2018 and 2019 baseline data, the PM10, VOC, and radionuclide data collected are consistent indicating **building demolition activities had no impact on the site air conditions.**”

³² During 2020, DOE demolished buildings 4029, 4133 and all ten buildings in the RMHF.



8.0 OFFSITE MEDIA SAMPLING

Monitoring the environment for potential impact from past nuclear operations has been a primary focus of Boeing and its predecessors for decades.

In the mid-1950s, Atomics International, then a Division of North American Aviation, began initial plans for nuclear research at its facilities in the west San Fernando Valley. In 1956, prior to initial operations, it began an ambitious monitoring program to baseline, and then to track, potential changes in environmental levels of radioactivity in and around its facilities.

During the 60-year history of nuclear research and later environmental restoration, on-site and off-site environmental monitoring and media sampling has been extensive. In the early years, offsite soil/vegetation sampling was conducted, on a monthly basis, as far west as the Moorpark freeway, as far North as the Simi Valley freeway, as far east as Reseda, and as far south as the Ventura freeway. Soil, vegetation, and water samples were also taken around the Canoga and De Soto facilities, and around the Chatsworth Reservoir. This extensive off-site sampling program was terminated in 1989 when all nuclear research and operations (except remediation) came to an end. See [Section 7.1](#) for original reports of this data.

8.1 Boeing and Third-Party Sampling Programs

During the 1990s and 2000s, extensive media sampling programs were conducted on our northern neighbors (including the Brandies-Bardin Institute and the Santa Monica Mountains Conservancy), our Bell Canyon neighbors to the south, Runkle Ranch, Ahmanson Ranch, Dayton Canyon, the Chatsworth Reservoir, the Boeing Recreation Center in West Hills, various private homes in the Chatsworth and West Hills areas, and places as far afield as Wildwood Park and Tapia Park. Independent sampling has been performed by at least eighteen independent organizations.

More detail including original reports are provided for all these projects in the following sections.



Extensive Radiological Monitoring Since 1956 Has Demonstrated that SSFL Operations Have Not Resulted in a Health Risk to Neighboring Communities

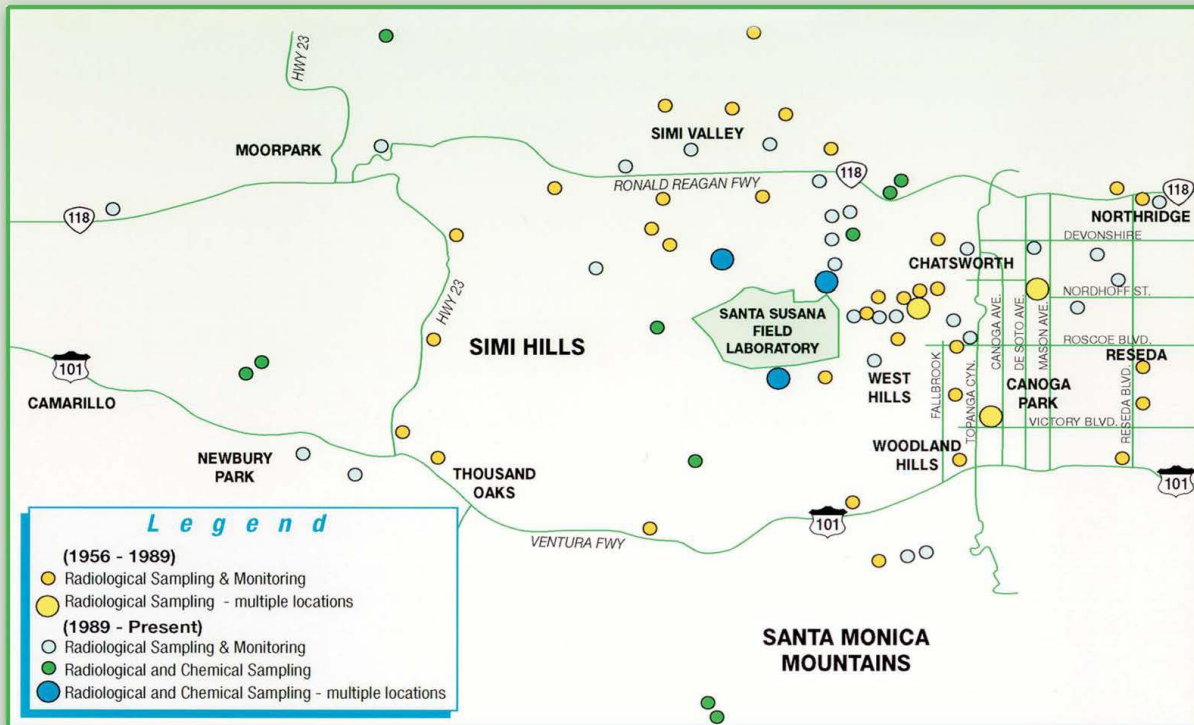


Figure 8. Offsite Media Sampling Map (compiled in 2005)
<https://www.etec.energy.gov/graphics/OffsiteSamplingMap.jpg>



Table 7. Offsite Media Sampling (compiled in 2005)

https://www.etec.energy.gov/Environmental_and_Health/Documents/HistoryDocs/MediaSampling.pdf

Environmental Sampling for Radiation/Radioactivity Surrounding Santa Susana					
Location	Media Sampled (Date Range and Organization)				
	Soil	Groundwater	Surface water	Airborne Particulates	Radiation Exposure
On-site	1956-Present (Rocketdyne) 1975, 81, 84 (ANL) 1986-87 (ORAU) 1992-Present (ORISE) 1993 (RWQCB) 1992-Present (DHS-RHB) 1994-95 (DHS-EMB)	1960-86 (Rocketdyne) 1984-Present (GRC/HA) 1998 (EPA-ORIA)	1970-Present (Rocketdyne) 1993-98 (RWQCB)	1956-Present (Rocketdyne)	1971-Present (Rocketdyne) 1975, 81, 84 (ANL) 1981-Present (DHS-RHB) 1986-87 (ORAU) 1992-Present (ORISE)
North Off-site	1956-89 (Rocketdyne) 1992-94 (McLaren-Hart) 1992-94 (EPA-ORIA) 1992-94 (DHS-EMB) 1991-97 (Cehn) 1995 (Rocketdyne) 1995 (ORISE)	1984-Present (GRC/HA) 1991-96 (Cehn) 1998 (EPA-ORIA)	1992-94 (McLaren-Hart) 1992-94 (EPA-ORIA) 1992-94 (DHS-EMB) 1992-94 (Cehn)	1989 (DHS-RHB & LLNL)	1974-Present (Rocketdyne) 1992-94 (EPA-ORIA) 1995 (ORISE)
East Off-site	1956-89 (Rocketdyne) 1986 (ORAU) 1994 (Rocketdyne) 1995 (ORISE) 1997 (LLNL) 2004 (Essentia)	1984-Present (GRC/HA) 2004 (Essentia)	1961-71 (Rocketdyne)	1959-Present (Rocketdyne)	1974-Present (Rocketdyne) 1986 (ORAU) 1995 (ORISE)
South Off-site	1956-89 (Rocketdyne) 1992-94 (McLaren-Hart) 1992-94 (EPA-ORIA) 1992-94 (DHS-EMB) 1992-94 (Cehn) 1995 (Rocketdyne) 1998 (Ogden)	1984-Present (GRC/HA)	1966-89 (Rocketdyne)	1989 (DHS-RHB & LLNL)	1974-Present (Rocketdyne)
West Off-site	1956-64 (Rocketdyne) 1992-94 (McLaren-Hart) 1992-94 (EPA-ORIA) 1992-94 (DHS-EMB) 1992-94 (Cehn) 1995 (Rocketdyne) 1999 (Kleinfelder) 1999 (QST) 1999 (Foster Wheeler) 2003 (Miller Brooks)	1984-Present (GRC/HA) 2003 (DHS-RHB)	1999 (Kleinfelder)	None	1974-Present (Rocketdyne)



Table 8. Offsite Media Sampling Organizations (compiled in 2005)

Organizations Conducting Radiological Environmental Sampling	
ANL	Argonne National Laboratory
DHS-EMB	Department of Health Services - Environmental Management Branch
DHS-RHB	Department of Health Services - Radiologic Health Branch
EPA-ORIA	Environmental Protection Agency - Office of Radiation and Indoor Air
Essentia	Essentia Management Services (for L.A. Dept. of Water & Power)
GRC/HA	Groundwater Resources Corporation. Later Haley & Aldrich
Cehn	Joel Cehn - Consultant for Brandeis-Bardin Institute
Foster Wheeler	Foster Wheeler Environmental Corp. (for Runkle Ranch)
Kleinfelder	Kleinfelder Inc. (for Ahmanson Ranch)
LLNL	Lawrence Livermore National Laboratory
McLaren-Hart	McLaren-Hart Environmental Engineering Corp.
Miller Brooks	Miller Brooks Environmental Inc. (for Runkle Ranch)
ORAU	Oak Ridge Associated Universities
ORISE	Oak Ridge Institute of Science and Education
Ogden	Ogden Environmental and Energy Services
QST	QST Environmental Inc. (for Runkle Ranch)
RWQCB	Regional Water Quality Control Board
Rocketdyne	Rocketdyne Propulsion & Power (or Atomics International)

8.2 Ahmanson Ranch (2000-2003)

Ahmanson Ranch was a proposed housing development to the south-west of the Santa Susana Field Laboratory (SSFL). Various anti-development organizations, including Save Open Space (SOS),³³ opposed this housing development on the grounds of increased traffic flow, etc. Ahmanson's proximity to SSFL quickly became a convenient scapegoat for the opposition parties. The Ahmanson project was ultimately terminated in 2003 as a result of the NIMBY opposition. The land is now known as the Upper Las Virgenes Canyon Open Space Preserve and is a favorite hiking/biking/running/equestrian/dog walking area. It is managed by the Santa Monica Mountains Conservancy (SMMC)/Mountains Recreation & Conservation Authority (MRCA). Access trailheads are on Victory Blvd. and Vanowen Blvd. from the east and on Las Virgenes Road from the south.

³³ Save Open Space. Available at <https://saveopenspace.com/>. Accessed September 6, 2022.

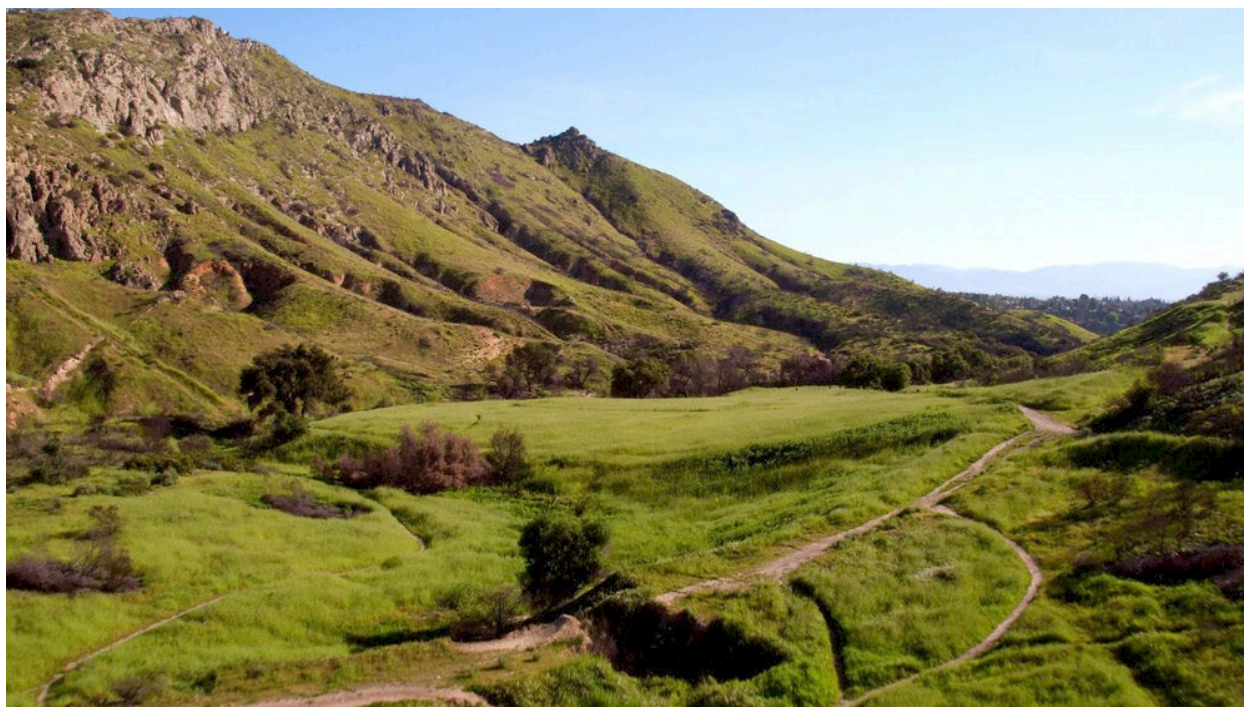


Figure 9. Upper Las Virgenes Canyon Open Space Preserve

A principal soil sampling project funded by the Ahmanson developer was known as the **Kleinfelder** study. The Kleinfelder report is extracted below, focusing on the radiological results.

- Kleinfelder, [Report of Environmental Sampling, Ahmanson Ranch, Ventura County, California](#), January 27, 2000. DOE Source.

None of the Kleinfelder data indicated any radiological contamination. Cesium-137 detected in Ahmanson soil and reported by Kleinfelder was <0.014, 0.085, 0.14, 0.032, 0.12 and <0.035 pCi/g. Each of these samples is well below the background threshold value (BTV) of local cesium-137 of 0.193 pCi/g established by the EPA in 2011.³⁴ Clearly the cesium-137 measured at Ahmanson is consistent with local background cesium-137 and not from SSFL operations.

Several commentators including [UCLA](#) and [SOS](#) have taken advantage of typographical errors in the Kleinfelder report. Page 24 of the Kleinfelder report reported a range for cesium-137 as 0.14 to 0.32 pCi/g. This is incorrect. The report used an incorrect maximum cesium-137 value of 0.32 pCi/g (sample S-4). The original lab data and Table 16 for sample S-4 gives a

³⁴ EPA, "Final Radiological Background Study Report, Santa Susana Field Laboratory, Ventura County, California", October 2011. Available at https://www.etec.energy.gov/Library/Cleanup_and_Characterization/Soil/Co-Located/2-Final%20Radiological%20Background%20Study%20Report.pdf. Accessed September 6, 2022.



correct value of 0.032 pCi/g for cesium-137. The range of cesium-137 detected at Ahmanson Ranch is therefore non-detect to 0.14 pCi/g.

In 2004, Mary Weisbrock of SOS made incorrect assertions about the Kleinfelder data. These were corrected in the following Boeing letter to the Ventura County Board of Supervisors.

- Rutherford/Boeing, [Response to the Exponent Review of the Ahmanson EIR](#), January 20, 2005. Author Source.

In June 2003, the California Department of Health Services sampled the groundwater at the Ahmanson Ranch and failed to find any contamination.

- DHS/RHB, [Ahmanson Ranch Groundwater Sampling](#), June 2003. DOE Source.

The DHS concluded,

- *"Based on the wells tested at the Ahmanson Ranch property by RHB in June 2003, no evidence was found that the Ahmanson Ranch property groundwater has been impacted by man-made radioactive contamination, or that radioactivity had migrated from the SSFL site to the Ahmanson Ranch groundwater."*

8.3 American Jewish University (AJU) (2016-2022)

The American Jewish University (AJU) was formally known as the Brandeis-Bardin Institute. AJU is the SSFL's immediate neighbor to the north. Extensive sampling of media on BBI was conducted in the early 1990s. See [Section 8.5](#) for the early Brandeis-Bardin Institute sampling.



Figure 10. American Jewish University

This section addresses an additional data review by DTSC and additional sampling by **Tetra Tech** and **GIS International** following an attack on AJU and SSFL by Los Angeles TV Channel NBC4 I-Team headed by Joel Grover.³⁵

Following the 1992-1996 sampling of the Brandeis-Bardin Institute by McLaren Hart, Joel Cehn conducted annual sampling until 2017. All his annual reports can be viewed at [Brandeis-Bardin Safety Data](#). Mr. Cehn's final 2017 report is,

- Cehn, [2017 Testing Results](#), March 27, 2017. AJU Source.

Cehn's conclusions were,

- *"Results are unremarkable."*
- *"Analytes are at or near background levels, or not present at all."*
- *"Results continue to show that the BBC property is free of contamination."*
- *"Drainage ravine sediments that could potentially carry contaminants toward BBC are free of contamination."*
- *"Groundwater near the property line contains trace levels of tritium, but these are diminishing."*
- *"I wouldn't recommend further testing for at least another year."*

³⁵ NBC4 I-Team, "LA's Nuclear Secret." Available at <https://data.nbcstations.com/national/KNBC/la-nuclear-secret/>. Accessed November 13, 2022



Tetra Tech conducted sampling in 2017.

- Tetra Tech, [Executive Summary](#). AJU Source.
- Tetra Tech. [Environmental and Radiological Data Summary and Health Risk Evaluation for the American Jewish University Brandeis-Bardin Campus at Simi Valley, California](#). April 2016. AJU Source..
- Tetra Tech, [Frequently Asked Questions – Tetra Tech Environmental Study of the Brandeis-Bardin Campus](#). AJU Source.

Tetra Tech's conclusions were,

- *"Tetra Tech's risk evaluation is consistent with prior risk assessments for off-site areas that found no appreciable risks at the BBC through soil exposure pathways. It demonstrates that human health risks associated with BBC soils are well below levels of concern and are consistent with background levels."*
- *"Tetra Tech's risk evaluation, literature review, and background comparison analysis of all available site data indicate that the environmental and radiological conditions at the BBC pose no unacceptable human health risk to campers, camp counselors, visitors, or residents at the site."*

DTSC reviewed and summarized all previous sampling data

- DTSC. [Community Update. The American Jewish University, Brandeis Bardin Institute](#). May 2017. DTSC Source.
- DTSC, [Executive Summary of DTSC's May 2017 Technical Memorandum On the American Jewish University – Brandeis-Bardin Institute Campus](#), May 2017. DTSC Source.
- DTSC. [Review of Radiological and Chemical Data from Investigations Conducted at and Near the Santa Susana Field Laboratory and the American Jewish University - Brandeis Bardin Institute](#). May 2, 2017. DTSC Source.

DTSC's technical memorandum concluded,

- *"Levels of radionuclides at the Brandeis Bardin property are within the range of local background"*
- *"Levels of chemicals and radionuclides at the Brandeis Bardin Campus are safe for human health, as determined using risk based screening levels derived using state and federal standards and guidelines"*
- *"Contamination at SSFL does not pose a health threat to users of Brandeis Bardin Institute or other offsite areas"*
- *"The Brandeis Bardin campus is safe for use by campers, visitors, students, faculty, administrators and staff."*



Since 2019, AJU have contracted with GSI Environmental Inc. to perform annual sampling at the Brandeis-Bardin Campus.

- GSI, [2019 Monitoring Report - AJU - BB Campus](#), November 25, 2019. AJU Source.
- GSI, [2020 Monitoring Report - AJU - BB Campus](#), August 5, 2020. AJU Source.
- GSI, [2021 Monitoring Report - AJU - BB Campus](#), August 24, 2021. AJU Source.
- GSI, [2021 Environmental Summary - AJU - BB Campus](#), November 12, 2021. AJU Source.
- GSI, [2022 Monitoring Report - AJU - BB Campus](#), July 28, 2022. AJU Source.

GSI's summary in their 2021 Environmental Report stated,

- *"Historical environmental investigations beginning in 1992 have uniformly found that there has been no significant migration of any contaminants from the SSFL to the Campus."*
- *"In 2017, the California Department of Toxic Substances Control (DTSC) analyzed the historical data and concluded that contaminants from the SSFL did not pose a health risk to users of the Campus."*
- *"GSI's annual sampling, conducted at the Campus' southern border and in high-use areas of the property since 2019, confirm that there has been no significant migration of contaminants from the SSFL."*
- *"The evidence shows that the monitoring and mitigation measures implemented at the SSFL are effectively containing contaminants and preventing off-site migration."*

The American Jewish University website summarizes its environmental data at ...

- AJU, [Brandeis-Bardin Safety Data](#). AJU Source.
- AJU, [AJU's Brandeis-Bardin Campus and the Santa Susana Field Laboratory](#), March 2019. AJU Source.

8.4 Bell Canyon (1998)

Bell Canyon is a gated community, immediately to the south of the Santa Susana Field Laboratory (SSFL). In 1997, several residents of Bell Canyon requested that Boeing perform sampling of their back yards and other locations in Bell Canyon in order to determine if contaminants from SSFL had migrated onto their residences.



Figure 11. Bell Canyon

Boeing hired **Ogden Environmental** to develop a workplan and perform the sampling. The work plan was reviewed by the Department of Toxic Substances Control (DTSC), the Department of Health Services (DHS) and the Environmental Protection Agency (EPA).

- Ogden, [Bell Canyon Residence Sampling - Soil Sampling Work Plan, Ventura County, California. Volume I](#), June 1998. DTSC Source.
- Ogden, [Bell Canyon Residence Sampling - Soil Sampling Work Plan, Ventura County, California. Volume II. Attachments](#), June 1998. DTSC Source.

The field work was conducted in the summer of 1998. The above-mentioned agencies provided oversight of the field work and took split samples. In addition, Boeing hired an environmental professor from California State University, Northridge (CSUN) to assist in explaining sampling protocols and health issues to residents.

Residents helped pick specific sampling locations with advice from agency members and the CSUN professor. Three residences were sampled, in addition to Bell Creek, SSFL drainage paths into Bell Canyon, and undeveloped land on SSFL and in Bell Canyon.

A report was issued in October 1998, documenting the results.

- Ogden, [Bell Canyon Area Soil Sampling Report - Ventura County, California - Volume I](#), October 1998. DTSC Source.



- Ogden, [Bell Canyon Area Soil Sampling Report - Ventura County, California - Volume II](#), October 1998. DTSC Source.

The following is a quote from the report's conclusions:

"Overall the results of the investigation indicate that neither chemical nor radionuclide contaminants from the SSFL appear to have migrated into the Bell Canyon area. Based on the results of the soil and/or sediment samples collected in the Bell Canyon area during the investigation, the following conclusions can be made,

- *"All sample results in this investigation are substantially less than the health-based comparison values. The only exceptions are the arsenic concentrations which are similar to or less than background values."*
- *"Sample results at the three residences, Bell Creek and SSFL drainages are generally less than or similar to the background concentrations detected during this program."*
- *"Although the dioxin and tritium results for some samples exceed the background range in this study, these values are less than health-based levels."*
- *"There does not appear to be any trend or pattern in the distribution in the sampling results in the Bell Canyon area except for selected metals and dioxins."*
- *"Metal concentrations detected in samples collected from soils overlying the shale member of the Chatsworth Formation (primarily located in the eastern portion of Bell Canyon) are similar to each other and contain higher concentrations of selected metals than those detected elsewhere in Bell Canyon."*
- *"Dioxin concentrations greater than background but below the health-based levels generally occur in the drainages leading to Bell Creek or in Bell Creek. Within these drainages, however, there does not appear to be a consistent pattern to the dioxin concentrations, nor do they increase in the direction of SSFL. These observations suggest that the higher dioxin concentrations may result from natural processes."*
- *"Sampling results for surface and slightly deeper sediments are similar."*
- *"The acetone, fluoride, and chloride concentrations detected in the sample collected near the Equestrian Center are greater than background. These results are likely related to activities at the stables because they were not detected at similar levels elsewhere in Bell Canyon."*

In October 1998, the results of the sampling project were presented to the residents of Bell Canyon in a town-hall meeting.

- Ogden, [Results of Sampling in the Bell Canyon Area](#), October 18, 1998. DOE Source.

The EPA reviewed the work plan, provided oversight of the field work, took split samples, and analyzed the samples for radiological constituents. The following are the EPA results which confirm the Ogden results.



- EPA, [Radionuclide Results for Bell Canyon - Gamma Emitting Radionuclides](#), November 20, 1998. DOE Source.
- EPA, [Radionuclide Results for Bell Canyon - Gross Alpha and Beta Analysis](#), December 7, 1998. DOE Source.³⁶
- EPA, [Partial Split Sampling Results from Bell Canyon Sampling](#), February 17, 1999. DOE Source.
- EPA, [Radionuclide Split Sampling Results - Strontium, Plutonium, Uranium and Thorium](#), June 21, 1999. DTSC Source.

The DTSC took split samples for chemical analysis. DTSC concluded that the dioxin levels observed at Bell Canyon were safe.

- DTSC, [Bell Canyon Soil and Sediment Sampling](#). May 27, 1999. DOE Source.
- DTSC, [Evaluation of Analytical Results from Soil & Sediment Samples Collected in Bell Canyon](#). June 18, 1999. DOE Source.

8.5 Brandeis-Bardin Institute and Santa Monica Mountains Conservancy (1991, 1992 and 1994)

In the early 1900s, the Brandeis-Bardin Institute (BBI) was a Jewish cultural center, learning facility, and retreat. Subsequently it was renamed the American Jewish University (AJU) Brandeis-Bardin Campus (BBC). It is Boeing's immediate neighbor to the north of the SSFL. The Santa Monica Mountains Conservancy (SMMC) owns the Sage Ranch campground immediately to the north-east of SSFL.



Figure 12. Brandeis-Bardin Institute

³⁶ Given Greg Dempsey's criticisms of ETEC's alpha/beta soil sampling in [Section 3.2](#), it was curious to see EPA reporting alpha/beta analyses, especially since no background or risk standards exist for alpha/beta in soil.



Figure 13. Sage Ranch Looking Towards SSFL

In May 28-29, 1991, Joel Cehn conducted a small sampling program on BBI property. Cehn's results were generally consistent with background, with one sample (CR4), close to the SSFL boundary, with possibly elevated cesium-137.

- Cehn, [Results of Environmental Radiation Survey at Brandeis-Bardin Institute](#), July 1991. DTSC Source.

In the early 1990s Rockwell International, Boeing's predecessor, conducted a study of radiological and chemical contaminants on these two properties. Rockwell's contractor for the sampling was **McLaren Hart**. The work plan³⁷ for the project was reviewed and approved by the USEPA, the California DHS, the CalEPA, a BBI consultant (Joel Cehn), and Dan Hirsch. In addition these stakeholders took split samples which are also reported in the project documents below.

The work was conducted in two phases. Phase I field work was conducted in 1992 and documented in 1993. Phase II field work was conducted in 1994 and documented in 1995.

Phase I

- McLaren Hart, [Multi-Media Sampling Report Volume 1](#), March 10, 1993. DOE Source.
- McLaren Hart, [Multi-Media Sampling Report Volume 2](#), March 10, 1993. DOE Source.

³⁷ The author has been unable to locate a copy of the Phase I work plan.



- McLaren Hart, [Brandeis-Bardin Ravine Analytical Data](#), March 10, 1993. DOE Source.
- McLaren Hart, [Brandeis-Bardin Human Activity Area Analytical Data](#), March 10, 1993. DOE Source.
- McLaren Hart, [Santa Monica Mountains Conservancy Analytical Data](#), March 10, 1993. DOE Source.
- McLaren Hart, [Quality Assurance / Quality Control Data](#), March 10, 1993. DOE Source.

Phase II

- McLaren Hart, [Work Plan for Additional Soil and Water Sampling](#), October 22, 1993. DOE Source.
- McLaren Hart, [Additional Soil and Water Sampling](#), January 19, 1995. DOE Source.

The principal conclusions of the combined phases were ...

- Two locations, close to the SSFL boundary, had detectable cesium-137 at an average of 0.113 pCi/g higher than local background and detectable strontium-90 at an average of 0.051 pCi/g higher than local background. Both these values are approximately twice local background but well below the EPA-quoted U.S. background of 0.7 pCi/g.
- Tritium was also detected in soil within several hundred feet of the SSFL boundary immediately north of the prior location of Building 4010, a building already identified as a historical source of tritium. The levels were ~12,000 pCi/L of water in soil (less than the drinking water standard of 20,000 pCi/L).
- One location just to the north of the SSFL boundary near the SRE had detectable, but low levels of plutonium-238 during the Phase I sampling, however subsequent Phase II sampling two years later, in the same location failed to confirm any detectable plutonium-238.
- The U.S. Environmental Protection Agency (EPA) determined that *"radionuclides do not pose a threat to human health and the environment"* and that *"the theoretical cancer risk to campers is less than EPA's threshold level for action of one in 1,000,000."* These locations are now Boeing-owned land.
 - EPA, [U.S. EPA Announces Results of Rocketdyne's Off-Site Sampling Program for the SSFL](#), July 1995. DOE Source.
- McLaren Hart also detected trichloroethylene (TCE), a nonradioactive solvent, in a groundwater well on the Santa Monica Mountains Conservancy property. Boeing continues to address TCE contaminated groundwater at SSFL through its monitoring and cleanup program with the oversight of the California Department of Toxic Substances Control (DTSC).



Periodically, questions were raised related to the trace levels of plutonium-238 measured on Brandeis property during the 1992 sampling. The presence of Pu-238 was not confirmed by more extensive sampling at the same location during 1994. That portion of Brandeis-Bardin was purchased by Rockwell International in 1997 and is now known as the “Northern Buffer Zone (NBZ).” Further detail on the plutonium-238 issue is addressed in ...

- Rutherford/Boeing, [Plutonium-238 at Brandeis-Bardin](#), July 29, 2008. DOE Source.

Conclusions of this report were,

- *“Appendix D of the 1992 sampling report showed that all samples were non-detect for plutonium-239 which is the plutonium isotope usually associated with nuclear reactor operation. Plutonium-238 is associated with radioisotope thermal generators (RTGs) used to power satellites. No RTG work was performed at SSFL.”*
- *“If the 0.22 pCi/g Pu-238 level had been real, and assuming conservatively that Pu-238 background was zero, and assuming conservatively that all the soil in the RD-51 watershed was contaminated to the maximum 0.22 pCi/g level, then the theoretical residential EPA risk would be $0.22/2.97 = 7.4 \times 10^{-8}$, which is less than the lower end of the USEPA CERCLA 10^{-6} to 10^{-4} acceptable risk range. The RD-51 watershed area of Brandeis-Bardin is of course open-space parkland and not residential. Consequently conservative, hypothetical risks would be even less.”*
- *“The Pu-238 issue has been addressed several years ago in Boeing’s response to the UCLA Cohen report on off-site exposure potential.”*

8.6 Chatsworth Nature Preserve/Reservoir (2004-2010)

The Chatsworth Reservoir is a dry reservoir located two and a half miles to the east of the Santa Susana Field Laboratory. It is owned by the Los Angeles Department of Water & Power and is currently closed and used as a wildlife refuge. It was used as a potable water reservoir from 1919 to 1969. In 1970, it was drained for renovation and brush/vegetation clearing. Following the 1971 Sylmar earthquake, LADWP determined that the southern dam did not meet then current seismic codes and the decision was made to not refill the reservoir. In 1997, it was renamed the Chatsworth Nature Preserve.



Figure 14. Early View of Chatsworth Reservoir



Figure 15. Chatsworth Nature Preserve Today



Atomics International sampled soil and water from the reservoir in the 1950s and 1960s and results are reported in the Site Environmental Reports³⁸ of the time. No contamination was observed. This activity is discussed in correspondence with Dan Hirsch in 2006.

- Email from Phil Rutherford to Dan Hirsch, [SSFL - Chatsworth Reservoir Sampling](#), August 22, 2006. Author Source.

In 2004, **Essentia Management Services** conducted a Soil Suitability Evaluation for the Los Angeles DWP of the soil in the Chatsworth Reservoir for the purposes of using the soil as a "borrow" site. Chemicals and radionuclides were analyzed. This included gamma emitting radionuclides (cesium-137, potassium-40), strontium-90, uranium, and thorium. No contamination above background levels was detected. Cesium-137 and strontium-90 were reported as non-detect. The report concluded that, *"the unsaturated soil and groundwater underlying the reservoir bottom do not appear to contain constituents that would pose a health risk if the soil were used as a borrow material for earthworks construction for future industrial LADWP projects."*

- Letter from Susan Damron (LADWP) to David Bacharowski (LARWQCB), [Public Records Act Copy Request - Chatsworth Reservoir Sampling and Testing](#), July 27, 2004. DOE Source.
- Attachment to above letter, [Final Site Investigation Report - Soil Suitability Evaluation Chatsworth Reservoir, Chatsworth, California](#), July 22, 2004. DOE Source.

In 2008 and 2010, **Kleinfelder West Inc.** completed Phase I and II Environmental Site Assessments of the Chatsworth Reservoir.

- Kleinfelder West Inc., [Limited Phase II Environmental Site Assessment](#). May 2, 2008. Author Source.
- Kleinfelder West Inc., [Phase I Environmental Site Assessment](#). July 1, 2010. Author Source.
- Kleinfelder West Inc., [Phase I and II Environmental Site Assessment](#). July 1, 2010. Author Source.
- Kleinfelder West Inc., [Phase II Environmental Site Assessment and Human Health Screening Evaluation](#). July 2, 2010. Author Source.

The conclusions of the ESA and HHSE were,

- *"The likelihood of adverse health effects was assessed by comparison of maximum and 95% upper confidence limit (95% UCL) of the mean concentrations to health-based screening levels developed by Cal/EPA and federal EPA. Three metals (arsenic, cadmium,*

³⁸ DOE, "Annual Site Environmental Reports." Available at https://www.etec.energy.gov/Environmental_and_Health/ASER.php. Accessed September 9, 2022.



and vanadium) and two radionuclides (strontium-90 and potassium-40) were present at concentrations that exceeded health-based screening levels. These metals and radionuclides, however, were not considered to pose a health hazard that requires further investigation or remediation for the following reasons:"

- *"Arsenic – concentrations reported were within the range expected for naturally occurring background in California"*
- *"Cadmium – generally within the range of naturally-occurring background concentrations in California and the median concentration is less than the Cal/EPA screening level"*
- *"Vanadium – only one sample contained vanadium at a concentration greater than screening levels"*
- *"Strontium-90 – maximum activity was well below the occupational screening level consistent with proposed future land use"*
- *"Potassium-40 – reported concentrations are within the range of naturally occurring background concentrations"*
- *"Based on the results of the HHSE, further investigation or remediation is not considered to be warranted."*

These documents were reviewed, and data quality questioned.

- Rutherford/Boeing, [Boeing Review of Radiological Data in July 2, 2010 Kleinfelder Phase II Environmental Site Assessment for the Chatsworth Reservoir](#), November 24, 2010. Author Source.

8.7 Dayton Canyon (2005-2008)

Dayton Canyon was the location of a proposed housing development by [Centex Homes](#). The development, now completed, is called Sterling at West Hills. It is located north-west of the intersection of Roscoe Blvd. and Valley Circle Blvd. in West Hills and is less than a mile from the eastern property boundary of the Santa Susana Field Laboratory (SSFL).



Figure 16. Dayton Canyon



Perchlorate

In May 2005, preliminary soil sampling of the property by **Allwest Remediation** indicated elevated perchlorate concentrations far exceeding the maximum concentrations ever found on SSFL. The highest sample from Dayton Canyon was 62,000 ppm (mg/kg) or an amazing 6% by mass.

The distribution of perchlorate suggested that it had recently been deposited at the site. Perchlorate is very soluble in water, yet substantial concentrations were detected on the surfaces of leaves, on the surfaces of rocks and on the soil surface, yet none was detected in sub-surface soil at relatively modest depths. Furthermore there was no pattern of increasing perchlorate in the drainage channels leading up to the SSFL property. Indeed, soil samples taken in the drainage closer to the SSFL property line were non-detect for perchlorate. Storm water run-off from SSFL draining towards Dayton Canyon had been sampled in the recent past and no perchlorate had been detected above NPDES permit limits.

Subsequent sampling in late 2005 and early 2006, following rainfall, failed to detect any perchlorate. This verified that storm water is a very effective flushing and cleaning agent for perchlorate. It validated the fact that water transport from SSFL could not have been the cause of contamination and that the perchlorate had recently been dumped on the site by persons unknown.

The initial findings caused significant concerns by the [West Hills Neighborhood Council](#) and a committee was formed under the leadership Dr. Daniel Wiseman.³⁹

Radionuclides

Additional sampling was performed in October 2005 for cesium-137, and gross alpha and gross beta, and again in January 2006 for strontium-90, plutonium-238 and plutonium-239. The results were reported by Allwest. Allwest hired [Cabrera Services](#) to review and interpret the radiological data.

- Allwest Remediation, [Radiological Investigation Report - Dayton Canyon Site, West Hills, California](#), June 7, 2006, (Revised September 2006). DOE Source.
 - Allwest concluded, *"The results of the radiological investigation and evaluation do not indicate any radionuclide concentrations above the referenced background values."*
- Cabrera Services, [Technical Memorandum - Review and Evaluation of Radiological Survey and Laboratory Results for the Sterling Project, West Hills, California](#), May 23, 2006. DOE Source.

³⁹ Dr. Daniel Wiseman was a local physician who coincidentally was my son's pediatrician 15 years earlier.



- Cabrera concluded, *"Cabrera recommends that no additional radiological investigations be performed. It is unlikely that concentrations of the radionuclides of concern at the West Hills Project site result from activities at the SSFL. Based on the data available, it appears unlikely that any radioactivity has migrated from the SSFL onto the Sterling Property. Laboratory results, including those farthest west in the creek, did not indicate any radionuclide concentrations above the referenced background values."*

Nevertheless, the DTSC recommended further sampling and Allwest Remediation prepared a supplemental sampling and analysis plan in September 2006.

- Allwest Remediation, [Supplemental Radiological Investigation Sampling and Analysis Plan.](#) September 27, 2006. DOE Source.

In November 2006, Dan Hirsch published a report on Dayton Canyon.

- Hirsch, [Radioactive Contamination at Dayton Canyon from the Santa Susana Field Laboratory – Comments on Radiological Monitoring](#), November 13, 2006. DTSC Source.

The California Department of Health Services was asked to review the soil radionuclide data.

- DHS-RHB, [Letter from Gary Butner \(DHS\) to Sayareh Amir \(DTSC\)](#), February 22, 2007. DOE Source.

The DHS conclusions were,

- *"The cancer incidence risk from the combined, site average concentrations of Cesium-137, Strontium-90. Plutonium-238, and Plutonium-239/240 (background corrected except for the plutonium nuclides) based on residential land usage is below 1 E-6, with the highest combined cancer incidence risk for the four site sub-area averages (west area) being approximately twice the site average."*
- *"These concentrations and risks are below those that would pose an undue health and safety concern for residential land usage."*

Allwest Remediation published the results of the new round of sampling in June 2007.

- Allwest Remediation, [Supplemental Radiological Investigation Sampling and Analysis Results - Sterling Homes Development, West Hills, California.](#) June 4, 2007. DOE Source.

Conclusions from this new round of Allwest sampling were,

- *"Cesium 137 (Cs-137) - A total of 177 samples were analyzed for Cs-137. None of the samples were found to have detectable levels of Cesium 137."*



- *“Plutonium 238 (Pu-238) - A total of 72 step out samples were analyzed for Pu-238. There were no samples with detectable levels of Pu-238.”*
- *“Plutonium 239/240 (Pu-239/240) - A total of the 72 step out samples were analyzed for Pu-239/240. There were no samples with detectable levels of Pu-239/240.”*
- *“Strontium 90 (Sr-90) - A total of 177 samples were analyzed for Sr-90. 176 samples were found to be below acceptable detection limits. One soil pile sample WFILL2@1’ had a detectable level of Strontium-90 of 0.73 pCi/g. The other soil fill locations were also sampled and were found to have Sr-90 levels below detection limits.”*
- *“Based on the results of the extensive radiological testing conducted, no radiological contamination was encountered, with the exception of one elevated Strontium value in a small fill soil pile. Further, all of the results and the detection limits were below published risk levels for Sr-90, Cs-137 and Pu-238 and Pu-239/240.”*

Auxier & Associates was then commissioned to interpret the radiological data and calculate a risk assessment. Auxier issued its report in February 2008.

- Auxier & Associates, [Radiological Characterization of Dayton Canyon, West Hills, California](#). February 25, 2008. DOE Source.

Auxier concluded that,

- *“Using the available information presented in this report, no areas of radiological concern were identified in the canyon.”*
- *“Visual examination of concentration data plotted on aerial photos of the site indicates that the higher results are scattered across the site and not clustered together.”*
- *“A statistical comparison of surface and subsurface concentrations failed to prove that they were different populations. These two observations indicate soil concentrations of the radionuclides investigated are relatively uniform across the entire study area.”*
- *“The soil concentration data was used to calculate the exposure potential to a hypothetical receptor living on the property. Risks to this postulated receptor from Cs-137, Pu-238, Pu-239/240, and Sr-90 are relatively small, with the calculated upper-bound risk above background about 4×10^{-7} .”*
- *“Risks of this magnitude are less than the 10^{-6} to 10^{-4} risk range generally considered by EPA to be acceptable at Superfund sites.”*

On February, Allwest issued a Preliminary Endangerment Assessment (PEA) summarizing all previous sampling results and health risk assessments.

- Allwest Remediation, [Preliminary Endangerment Assessment – Stirling Homes – West Hills, California](#), February 28, 2008. DTSC Source.



The PEA conclusions were,

- *"The Sterling Homes property has been extensively investigated under the direction of the Department of Toxic Substance Control (DTSC). The site has been sampled and analyzed for perchlorate, heavy metals, Poly Aromatic Hydrocarbons, and hydrazine. No significant contamination has been identified since January 2006."*
- *"Noncarcinogenic PAHs, metals, dioxins/furans and VOCs were identified as COPCs on-site. The primary contaminant of concern at the site is perchlorate. Although perchlorate was initially found in 35 of 332 samples collected as part of the initial phase of the PEA Investigation prior to 2006, a supplemental Investigation was conducted after the rainy season in April 2006 to determine the effect the creek flow had on the distribution of perchlorate in the Dayton Canyon Creek. An additional 122 samples collected and analyzed showed no detectable concentrations of perchlorate, indicating that the increased creek flow during the rainy season rain had washed all detectable traces of perchlorate away. Based on the foregoing, perchlorate was excluded as a Contaminant of Potential Concern (COPC)."*
- *"Low levels of naturally occurring metals were detected in the site soils. Polyaromatic hydrocarbons, OCDD and OCDE were detected in the surface soils, but the levels detected were well below known risk levels. Supplemental sampling and testing in April 2006 showed no detectable concentrations."*
- *"Based on the results of the Preliminary Endangerment Assessment investigation and the Human Health Risk Assessment for the Sterling Homes Property, no significant health risks were identified for future site residents or the community."*

On October 10, 2008, DTSC issued a "no further action" letter to Centex Homes.

- Letter from Norm Riley (DTSC) to Rick Bianchi (Centex), [Preliminary Endangerment Assessment and Radiological Characterization of Dayton Canyon for Centex Homes - Sterling Property at Roscoe Boulevard and Valley Circle Boulevard, West Hills, Los Angeles County, California](#), October 10, 2008. DTSC Source.

DTSC stated,

- *"The report concludes that no significant health risks were identified during the PEA, and no further action is necessary."*
- *"In addition, the report presents the results of a radiological risk assessment that concludes that there are no significant health risks associated with contamination at the site."*
- *"DTSC agrees that the information provided in these reports does not indicate the presence of a threat to human health or the environment."*



In addition, in October 2008, DTSC also responded to public comments regarding Dayton Canyon.

- Letter from Norm Riley (DTSC), [Response to Comments on the Preliminary Endangerment Assessment and the Radiological Characterization of Dayton Canyon for the Centex Homes – Sterling Property at Valley Circle Boulevard and Roscoe Boulevard in West Hills, California](#), October 10, 2008. Author Source.
- DTSC, 68-page attachment to above letter, [DTSC Responses to Public Comments, Centex Homes - Sterling Property, West Hills, California](#). Author Source.

Finally, DTSC issued a press release.

- DTSC Press Release, [State Announces Finding Regarding Simi Valley Property – Investigations show Centex property in Dayton Canyon is safe for use](#). October 10, 2008. DTSC Source.

The press release stated,

- *"The California Department of Toxic Substances Control (DTSC) has issued a letter to Centex Homes stating that the results of the investigation of the Dayton Canyon property do not indicate the presence of a threat to human health or the environment."*
- *"DTSC cites an environmental investigation/evaluation complemented with a human health risk assessment, as the basis for its decision."*
- *"Our decision announced today is based on three years of environmental study," said DTSC Project Director Norman Riley. "Despite its proximity to the Santa Susana site, we conclude that there is not a presence of a threat to human health or the environment on the Centex property," Riley added.*

8.8 Orcutt Ranch and Justice Street School (2006)

Orcutt Ranch is located at the western end of Roscoe Blvd. in West Hills. It is a formally privately owned citrus grove and cattle ranch that is now owned by the City of Los Angeles. Orcutt Ranch is ¼ mile east of Dayton Canyon and approximately 1 mile from the eastern boundary of SSFL.

Justice Street Elementary School is a short distance from Orcutt Ranch along Justice Street.

Soil sampling was conducted at Orcutt Ranch in March and April 2006, along the original path of Dayton Creek before construction of the flood control channel. In addition, sampling was conducted at Justice Street School in April 2006. Soil samples were analyzed for perchlorate due to the contemporaneous attention that perchlorate was receiving at Dayton Canyon.



- DTSC Public Meeting, [Orcutt Ranch Park Sampling](#), April 19, 2006. DTSC Source.

All 25 samples at Justice Street School were non-detect. All 22 first round samples at Orcutt Ranch were non-detect except 2. Second round sampling in April at Orcutt Ranch failed to confirm the earlier detects.

DTSC's conclusions were,

- *"Preliminary data indicate that Perchlorate was not detected in any of the samples."*

8.9 Rocketdyne Recreation Center (1997)

The Rocketdyne Recreation Center was located at the northern end of Fallbrook Ave. in West Hills. Today, the location is a new housing development surrounding Fallbrook Park. It is approximately 2-3 miles from the Santa Susana Field Laboratory.



Figure 17. Rocketdyne Recreation Center (2013)



Figure 18. Fallbrook Park Today

In 1997, personnel from the Lawrence Livermore National laboratory (LLNL) conducted soil sampling at the Recreation Center and analyzed the soil for cesium-137.

- LLNL, [An Investigation on the Cesium-137 Content of Soil Collected from the Boeing North American Inc. Employees Recreational & Fitness Center](#), June 20, 1997. DOE Source.

The report concluded that,

- *"Sample collection and analysis did not reveal any evidence that cesium-137 present in these soils could have been derived from local contamination. Furthermore the levels and cesium-137 soil inventories over the study site can be adequately explained by direct deposition of global fallout through the period 1945-1997. This suggests that the data is derived from "background" concentrations."*

8.10 Runkle Canyon (1999-2010)

In 1999, Runkle Canyon was the site of a proposed housing development to the north-west of the Santa Susana Field Laboratory. Access to the area was from the southern end of Sequoia Ave, in Simi Valley. Today, in 2022, most homes have been constructed and occupied, and Runkle Canyon is a thriving community.



Figure 19. Runkle Ranch

From 1999 to 2003, as part of the environmental impact study for this project, various soil sampling programs were conducted at Runkle Canyon. These are listed chronologically below.

- QST Environmental, [Results of Preliminary Soil Sampling at Runkle Ranch at Simi Valley, California](#), February 5, 1999. DOE Source.
- Foster Wheeler, [Final Report - Runkle Ranch Site Investigation - Simi Valley, California](#), October 1999. DOE Source.
- Harding ESE, Results of Limited Soil Sampling, Rancho Simi Property, APN 6850-130-180, Simi Valley, California, November 3, 2000.⁴⁰
- Miller Brooks Environmental, [GreenPark Runkle Canyon LLC - Runkle Canyon Property in Simi Valley, California - Site Investigation Report of the Western 350-Acre Parcel](#), September 17, 2003. DOE Source.
- Miller Brooks Environmental, [GreenPark Runkle Canyon LLC - Runkle Canyon Property in Simi Valley, California - Site Investigation Report of the 550-Acre Parcel](#), September 17, 2003. DOE Source.
- Miller Brooks Environmental, [GreenPark Runkle Canyon LLC - Runkle Canyon Property in Simi Valley, California - Site Investigation Report of the Southern 715-Acre Parcel](#), September 17, 2003. DOE Source.

Boeing was unaware of these soil sampling programs at the time they were conducted, and

⁴⁰ The author has been unable to locate a copy of this report.



only received the reports in March 2005. Soil samples were analyzed for tritium, cesium-137 and strontium-90. Tritium was non-detect and cesium-137 was within local background levels. Strontium-90 however, appeared somewhat elevated compared to typical local background levels.

The following Boeing review of five of the six earlier reports was provided by email to Rob Greger of DHS-RHB and Peter Kiesecker, Runkle Canyon LLC, on March 14, 2004 and expands on these summary conclusions.

- Rutherford/Boeing, [Runkle Canyon Soil Sampling](#), March 12, 2005. Author Source.

Some of the conclusions of this review were,

- The Runkle Canyon Sr-90 reported levels exceeding local background levels, however they appear to be anomalous.
- Soil samples taken by Boeing contractors, EPA, and California Department of Health Services (DHS), in drainage areas offsite of SSFL to the northwest and north have not indicated Sr-90 significantly exceeding local background levels. These sampling programs do not support the Runkle Canyon Sr-90 levels.
- The Runkle Canyon Sr-90 is observed at levels, on average, 14 times higher than the Runkle Canyon Cs-137. This is contrary to published isotopic ratios for these fission products, which are generated during the fission process in approximately equal quantities in both atmospheric weapons tests and nuclear reactors. Typical contaminated soil onsite at SSFL contains Cs-137 at equal or greater concentrations than Sr-90, just the opposite of that observed in Runkle Canyon.
- The EPA acceptable risk range for Sr-90 in soil is 0.23 to 23 pCi/g. The average (1.4 pCi/g) and maximum (12.3 pCi/g) levels reported at Runkle Canyon by Foster Wheeler are well within this acceptable risk range.
- EPA and California DHS personnel expressed the opinion in a SSFL Work Group meeting that the levels of strontium-90 were sufficiently low that the Runkle Ranch land was safe for future residents.

In April 2005, the Runkle Canyon developer hired **Dade Moeller & Associates** to perform a risk assessment of the strontium-90.

- Dade Moeller & Associates, [Radiological Health Risks of Strontium-90 in Runkle Canyon Development, Simi Valley, California](#), DMA-TR-14, April 2005. DOE Source.

The report's conclusions were,

- *"Results indicate the actual radiological risk of constructing, using, and residing at Runkle Canyon would be lower than indicated by the default preliminary remediation guide (PRG).*



- *"The estimated site-specific PRG for a typical Runkle Canyon resident would be 18.6 pCi/g, while the PRG for an unlikely, more highly exposed resident would be 1.13 pCi/g. With an average soil concentration in proposed residential areas of 0.98 pCi/g, these calculated PRGs indicate the risk of exposure to Sr-90 in soil would be much less than 1E-6 for typical residents of Runkle Canyon and near 1E-6 for unlikely higher exposures."*
- *"Risks to an open space user would be lower, even though soil concentrations in open space areas are higher and include the highest observed soil concentrations. The PRG for an open space user would be 89 pCi/g for a long-term child-to-adult scenario, and 117 pCi/g and 263 pCi/g for an adult and child, respectively, corresponding to a risk of less than 1E-8."*
- *"The potential risk to a nearby neighbor from Sr-90 in airborne construction dust was also evaluated. Even using very conservative assumptions, the estimated risk to a nearby neighbor would be approximately 1E-10."*
- *"This technical evaluation indicates that construction and operation of Runkle Canyon would result in very low radiological health risk from Sr-90 exposure to residents, visitors, and neighbors. In all cases this risk would be less than the target risk level of 1E-6."*

In 2005, the DHS performed soil sampling at the locations that had shown the highest levels of strontium-90. All samples were non-detect, and the DHS was unable to confirm the prior elevated levels.

- DHS-RHB, ["DHS 2005 Soil Sample Results"](#), August 19, 2005. DOE Source.

In 2006, DHS was asked by the City of Simi Valley to perform a risk assessment of the earth moving operations preliminary to housing construction, and the associated risk from generating airborne strontium-90 contaminated dust. The DHS report concludes that *"the planned Runkle Canyon site development activities do not pose significant health & safety concerns to nearby residents or to site workers from strontium-90 that has been reported to exist at the site."*

- DHS-RHB, [Letter from Gary Butner \(DHS\) to Mike Sedell, Simi Valley City Manager, Untitled](#), November 8, 2006. DOE Source.

In April 2007, DHS responded to a variety of questions from community members.

- DHS-RHB, [Letter from Gary Butner \(DHS\) to Mike Sedell \(Simi Valley City Manager\), DHS Response to Community Questions](#), April 10, 2007. DOE Source.

In October 2007, Dade Moeller & Associates collected an additional 63 samples with 10 splits taken by the City of Simi Valley. Samples were analyzed for strontium-90. DTSC determined



that, *"Results were consistent with background levels when taking into account radioactive decay and uncertainty in the EPA background level."*⁴¹

In October 2008, DTSC and CDPH completed a review of 41 documents related to Runkle Canyon and requested that Runkle Canyon LLC prepare a response plan to address remaining data gaps.

- DTSC, [Letter from Norm Riley \(DTSC\) to Runkle Canyon LLC, Untitled](#), October 17, 2008. Author Source.

In December 2008, Dade Moeller & Associates published a Runkle Canyon Response Plan for Runkle Canyon LLC outlining further investigation and characterization plans, including further radiological sampling closest to the SSFL property line and removal of tar material.

- Dade Moeller & Associates, [Runkle Canyon Response Plan](#), December 4, 2008. Author Source.

In July 2010, both Dade Moeller & Associates, on behalf of Runkle Canyon LLC and DTSC, conducted final, separate soil sampling and analysis of Sr-90 and Cs-137. The results were reported in separate reports in December 2010 given below.

In September 2010, DTSC submitted responses to public comments received on the above Runkle Canyon Response Plan.

- DTSC, [Cover Letter - Responses to Public Comments](#), September 16, 2010. Author Source.
- DTSC, [Appendix 1 - Responses to Public Comments](#), September 16, 2010. Author Source.

In December 2010, DTSC presented the results of its July 2010 sampling and compared its results to those of Dade Moeller.

- DTSC, [DTSC Radiological Sampling and Analysis Report - Runkle Canyon](#), December 2010. DTSC Source.
- [Appendix B - Photographs of sampling locations](#). DTSC Source.
- [Appendix C - Eberline Analytical Report S008029-8113](#), August 27, 2010. DTSC Source.
- [Appendix C - Eberline Analytical Report S008030-8114](#), September 3, 2010. DTSC Source.

It is noteworthy that this is one of the few times that the author is aware, that DTSC has ever conducted media sampling themselves for any contaminant, let alone radionuclides. DTSC's conclusions were ...

⁴¹ The author has been unable to locate a copy of this report. Reference to EPA background level is assumed to refer to the 1995 [EPA Update on the Brandeis-Bardin Offsite Sampling Program](#).



- *"The goal of DTSC's investigation was to determine whether the strontium and cesium levels detected in the Foster Wheeler and Harding ESE investigations could be verified, and if those results are representative of current site conditions. DTSC's results are not consistent with the Foster Wheeler or Harding ESE results, and DTSC cannot verify either set of data."*
- *"DTSC's results are relatively consistent and in general are lower by over an order of magnitude, than the elevated levels of strontium or cesium seen in the Foster Wheeler data."*
- *"DTSC cannot verify the Foster Wheeler or Harding ESE results. DTSC suspects but cannot confirm that the Foster Wheeler and Harding ESE results may have been an artifact of the sampling methodology, laboratory analysis or lack of stringent quality assurance and quality control measures."*
- *"In any case, DTSC was not able to verify the results. Comparing the 2010 DTSC and 2010 Runkle Canyon LLC results shows consistent and reproducible results. DTSC's evaluation of the entire 2005, 2007, and 2010 data sets do not show a pattern that indicates there was either an on-site source or off-site release from SSFL."*

On December 7, 2010, a public meeting was held at which handouts were provided.

- DTSC, [Handouts on Runkle Canyon](#), December 7, 2010. Author Source.

On December 17, 2010, Dade Moeller & Associates, on behalf of Runkle Canyon LLC, issued a statistical evaluation and health risk assessment of soil samples taken pursuant of the revised Response Plan in July 2010.

- Dade Moeller & Associates, [Evaluation and Health Risk Assessment of Soil Sample Results for Runkle Canyon Pursuant to the Revised Response Plan](#), December 17, 2010. DTSC Source.
- Teledyne Brown Engineering, [Analytical Data - Work Order L43165](#), August 25, 2010. DTSC Source.

The report concludes ..

- *"Levels of Sr-90 and Cs-137 present in Runkle Canyon do not represent a significant health risk to future residents or visitors to the property."*
- *"The total risk from both Sr-90 and Cs-137 is shown to be less than 1 in 1 million."*
- *"The distributions of surface soil results for both Sr-90 and Cs-137 are generally consistent with the expected local background levels presented by EPA."*
- *"Overall, the results demonstrate the property is safe for future residents and visitors."*
- *"No further investigation or assessment is warranted at the property."*
- *"This report recommends a no further action determination by DTSC."*

On December 17, 2010, DTSC issued a no further action letter to Runkle Canyon LLC.



- DTSC, Letter from Mark Malinowski (DTSC) to Eric Hoffman (Runkle Canyon LLC), [Approval of Documents Related to the Evaluation and Cleanup of Runkle Canyon Pursuant to the July 22, 2010 Response Plan, Simi Valley, California](#). December 17, 2010. DTSC Source.

In the letter, DTSC stated,

- *"The Department of Toxic Substances Control (DTSC), based on its review of information submitted by Runkle Canyon LLC, and after careful review and evaluation of the analytical results provided and DTSC's independently collected data, concludes that no further action is necessary with respect to the Runkle Property."*
- *"Based on DTSC's review of the Evaluation Report, and after careful review and evaluation of the analytical results, DTSC concurs with the report conclusions that the concentrations of ⁹⁰Sr and ¹³⁷Cs at the site do not pose a significant health risk under an unrestricted, residential land use scenario and hereby approves the Evaluation Report."*
- *"DTSC concludes that no further action is necessary with respect to the subject property. This letter shall also serve as certificate of completion under section 25395.97 of CLRRRA that all response actions have been satisfactorily completed."*

In April 2013, DTSC wrote to the Mayor of Simi Valley in response to various questions related to SSFL,

- DTSC, Letter from Stuart Black (DTSC) to Robert R Huber (Mayor, Simi Valley), [Department of Toxic Substances Control's Response to City of Simi Valley's Letter on Santa Susana Field Laboratory](#), April 3, 2013. Author Source.

DTSC stated in the letter,

- *"To date we [DTSC] have not found evidence of off-site contamination from SSFL that would pose a risk to human health or the environment."*

8.11 Woolsey Canyon (2008)

Mountain View Village (MVV) is a mobile home community on Woolsey Canyon Road about one mile east of the SSFL main gate.



Figure 20. Mountain View Village

Residents of MVV requested that DTSC perform a variety of contaminant analyses including chemicals and radionuclides on the grounds of MVV. DTSC's legal counsel responded to the legal counsel of the facility's owner, Mountain View Estates (MVE), on January 29, 2008.

- DTSC, [Letter from Nancy Bothwell-Long to Donald Nanney \(Gilchrist & Rutter\), Untitled](#), January 29, 2008. DTSC Source.



Subsequent access issues were summarized in a further letter from Norm Riley, SSFL Project Director

- DTSC, [Letter from Norm Riley to Gary Gibson \(MVE\), Untitled](#), February 25, 2008. DTSC Source.

Following another two months of apparent internal squabbles about access, a sampling date of June 3, 2008, is established.

- DTSC, [Letter from Nancy Bothwell Long to Donald Nanney \(Gilchrist & Rutter\), Untitled](#), April 21, 2008. DTSC Source.

Following sampling on June 3, 2008, by DTSC and DPH-RHB personnel, a final report was transmitted to interested parties on September 8, 2008.

- DTSC, [Letter from Gerard Abrams to William McGregor with attached report: Limited Sampling Investigation, Mountain View Estates, Woolsey Canyon Road, Canoga Park, California](#), September 8, 2008. DTSC Source.

The DTSC report concluded ...

- *"Based on the limited data collected by DTSC, constituents detected at the Mountain View Estates appear to be very limited in nature and are more likely related to natural occurrences and on-site activities including the use of petroleum products and common household items and chemicals."*

Radionuclide data in DPH's memo indicates that ...

- All Cs-137 and Sr-90 results were below the decay corrected 95% UCL of the McLaren Hart background, and below the 2013 DTSC/EPA draft provisional LUTs.

8.12 Northern Drainage - Former Shooting Range (2007-Present)

The only offsite soil chemically impacted by SSFL was not from rocket engine tests or from nuclear operations, but from recreational trap and skeet shooting at the Rocketdyne/Atomics International Rifle and Pistol Club Inc. The club was independent from Rockwell International. The location of the Shooting Club was just west of the SSFL main gate and slightly overlapped the northern site boundary into the Sage Ranch property. The Shooting Club operated from 1972 to 1991.

Shooting debris, namely lead shotgun pellets and broken clay pigeon targets were present. Resulting toxic contaminants in soil are lead, antimony and polycyclic aromatic hydrocarbons (PAHs). Since an east-to-west drainage channel crossed the overshoot area, this debris and soil



contamination travelled in a westerly direction along what is known as the “Northern Drainage” during rainy seasons.

Numerous voluntary and regulatory ordered cleanup activities have been conducted from 1992 through 2013, that included not just shooting range debris but also miscellaneous industrial/residential trash (in 2008).

On November 1, 2007, DTSC issued Boeing and NASA an Imminent and Substantial Endangerment (ISE) Determination and Remedial Action (ISE/RA) Order for the Northern Drainage. On November 6, 2007, the RWQCB issued Boeing a Cleanup and Abatement Order for the Northern Drainage. Both orders included the Former Liquid Oxygen (LOX) Plant.

Boeing submitted a workplan to DTSC for approval.

- Boeing, [Former Shooting Range/Northern Drainage Clay Target Debris Removal Work Plan](#), Transmittal Letter. August 31, 2007. DTSC Source.
- Haley & Aldrich Inc., [Former Shooting Range/Northern Drainage Clay Target Debris Removal Work Plan](#), Part 1 of 2. August 31, 2007. DTSC Source.
- Haley & Aldrich Inc., [Former Shooting Range/Northern Drainage Clay Target Debris Removal Work Plan](#), Part 2 of 2. August 31, 2007. DTSC Source.

During this remedial program, DTSC was concerned with the need for radiological screening and waste certification. Boeing coordinated with the CDPH-RHB to establish and implement screening and sampling procedures in the Shooting Range and in the Northern Drainage.

- DTSC, Letter from James Pappas (DTSC) to Art Lenox (Boeing), [Conditional Approval for Imminent and Substantial Endangerment Determination and Order and Remedial Action Order - Required Work Plan - Former Liquid Oxygen Plant Debris Field Sage Ranch and SSFL](#), November 9, 2007. DTSC Source.

DTSC included the following requirement in its conditional approval.

- ***“Radiologic Screening of Excavated Material.*** *The Order requires the Respondents to submit a radiological screening procedure, developed with input from the Department of Public Health - Radiologic Health Branch (DPH-RHB), to screen excavated materials. Screening of excavated soils and debris shall be conducted to verify the excavated materials have no radiologic restrictions and do not violate any local, state, or federal requirements regarding their management, handling, or disposal. In response to this requirement by the Order, Boeing submitted "Northern Drainage Waste Sampling for Radionuclides", as an attachment to the transmittal letter "Response to DTSC Conditions in Imminent and Substantial Endangerment Determination and Order and Remedial Action Order", prepared by Boeing and dated November 6, 2007. DTSC understands that this written procedure was developed with input from the DPH-RHB.”*



- **“Conditions for approval:** DTSC concurs with the proposed Radiologic Screening of Excavated Material under the condition that it is clearly understood that it is the Respondents' responsibility to utilize the appropriate statistical evaluation of waste profiling sample analytical results, based on the respondents' understanding of the data distribution and limitations of each proposed statistical method. DTSC approves moving forward with the proposed radiologic screening procedures with the understanding that written verification, signed by the responsible agent of the Respondents, will be provided to DTSC.”

The Boeing procedure referenced by DTSC is.

- Boeing, [Northern Drainage Waste Sampling for Radionuclides, Rev. 9](#). November 5, 2007. DTSC Source.

Subsequent sampling data are provided in,

- Boeing, [Northern Drainage LOX Plant Debris/Asbestos Removal Action Report](#). February 29, 2008. DTSC Source
 - [Appendix C. Radionuclide Data](#). Pages 167 to 238
 - **“Section 4.4 Radionuclide Soil Sampling and Surveys:** As required by the DTSC Order, the LOX debris area and removed debris were sampled and surveyed for radionuclides in accordance with the procedures described in Northern Drainage Waste Sampling for Radionuclides. Results of sampling and waste certifications are presented in Appendix C. Field measurements were taken at the LOX debris field prior to and during cleanup activities. Results of the field measurements of solid debris were all indistinguishable from background. Soil and debris samples were also collected from the debris area prior to the commencement of cleanup activities. Results for these samples did not exceed local background for Cesium-137 or Strontium-90. All tritium results were non-detect.”
- Boeing, [Report on Former Shooting Range Debris Removal Action](#). May 28, 2009. DTSC Source.
 - [Appendix H. Northern Drainage Shooting Range Soil Sampling for Radionuclides and Waste Certification](#). Pages 2320 to 2492.
 - **“Section 4.6 Radiological Surveys:** Soil and debris removed from the former shooting range debris area were sampled and surveyed for radionuclides following the California Department of Public Health (DPH)-approved procedures described in the Work Plan Addendum, approved by the DTSC. Prior to the commencement of debris removal activities, a Boeing health physicist also conducted radiological field surveys of the shooting range area using a portable global positioning data logging device to record both position and gamma exposure. The results of the field surveys of the shooting range area were indistinguishable from background radiation. Larger pieces



of metal, concrete, and asphalt segregated during the debris removal activities were surveyed by a Boeing health physicist. The radiological survey of these discrete objects included gamma exposure, total beta contamination, and alpha/beta wipe tests. The results of the field surveys of the segregated solid debris were indistinguishable from background radiation. A copy of the "Northern Drainage Shooting Range - Field Survey of Solid Debris - Waste Certification" is included in Appendix H. The soil removed from the shooting range area was stockpiled or containerized and sampled for radionuclides following DPH-approved procedures described in the Work Plan Addendum. Forty-four stockpiles/bins generated from the debris removal activities were screened for radionuclides as listed in Table XII, in addition to other stockpiles/bins generated during lead overshoot removal activities in the former shooting range. The results of the soil sampling demonstrated that radionuclides were indistinguishable from background radiation as determined by Wilcoxon Rank Sum (WRS) statistical analysis of the radionuclide analytical results from stockpile/bin sampling. A copy of the "Northern Drainage Shooting Range Soil Sampling for Radionuclides - Results and Statistical Analysis - Waste Certification" is included in Appendix H. The details associated with the stockpile/bin sampling and disposal activities are discussed in Section 4.7."

Boeing submitted another Work Plan for the Shooting Range in August 2016.

- MWH, [Former Rocketdyne-Atomics International Rifle and Pistol Club Shooting Range Area Investigation Work Plan](#), August 2016. DTSC Source.

Boeing submitted an Addendum to the Shooting Range Work Plan in May 2018.

- Stantec, [Former Rocketdyne-Atomics International Rifle and Pistol Club Shooting Range Area Investigation Work Plan Addendum](#), May 2018. DTSC Source.

Boeing submitted a Data Summary and Findings Report (DSFR) for the Shooting Range in October 2018.

- Stantec, [Data Summary and Findings Report - Former Rocketdyne-Atomics International Rifle and Pistol Club Shooting Range Investigation Area](#), October 2018. DTSC Source.

The recent work plans for further field work at the Shooting Range and Northern Drainage make no mention of DTSC-required radiological surveys and sampling. It is assumed that the radiological results of the 2007-2009 removal action had convinced the DTSC that they no longer needed to be concerned about radiological contamination.



8.13 North-East Groundwater

The sandstone geology beneath the SSFL has successfully limited migration of TCE contaminated groundwater. As a result, most TCE contaminated plumes are limited to source locations at or near rocket test stands within the confines of the SSFL boundary. Only one plume has migrated across the site boundary at the north-east near the SSFL Main Gate.

Go to DTSC's [Document Library](#) and select RCRA Facility Investigation – Groundwater, for more information on TCE groundwater contamination.

DOE's ETEC website includes videos of [Groundwater University](#), a series of educational meetings held between March 8, and May 19, 2011, and hosted by Boeing's Groundwater Expert Panel.

8.14 Offsite Data Evaluation Report (2007)

In December 2007, Boeing issued an Offsite Data Evaluation Report, compiling the results of prior offsite sampling programs. Offsite data had been compiled from 18 field sampling and analysis programs. The report summarized and evaluated the results of offsite media sampling and testing data for chemical and radiological contaminants collected by Boeing, NASA and DOE within a 15-mile radius around the Santa Susana Field Laboratory over a nearly 60-year time period. This was a requirement of the 2007 Consent Order for Corrective Action.⁴²

"3.4.9. Within 120 days of the effective date of this Order, the Respondents shall prepare and submit to DTSC a report summarizing all off-site media sampling and testing data for chemical and radiologic contaminants conducted by the Respondents around SSFL. The summary report shall itemize all separate off-site sampling programs, specify the objectives, summarize the conclusions, and summarize results. The report shall include maps and figures of SSFL and surrounding areas showing sample locations, sample results, and sample identification numbers referenced to tables of the analytical results and sample information. The map or maps shall have a key which identifies the sample as to sample media type (air, surface water, soils, groundwater, seeps, and springs). The data table summaries shall be referenced to the original reports. The Respondents shall review the data and make conclusions and recommendations as to the completeness of the sampling, and recommendations for additional sampling if needed. A bibliography of all original work plans, Health and Safety Plans, Quality Assurance Plans and final reports shall be compiled, and electronic versions of those original reports shall be included on a CD with the report."

- MWH, [Offsite Data Evaluation Report, Santa Susana Field Laboratory, Ventura County, California](#). December 14, 2007. DOE Source.

⁴² DTSC, "Consent Order for Corrective Action", August 16, 2007. Available at https://www.etec.energy.gov/Library/Cleanup_and_Characterization/Consent_Order.pdf#page=17. Accessed September 5, 2022.



- [Appendices A through D](#). DOE Source.
 - [Appendix A - Searchable Offsite Program Document Database](#). DTSC Source.
 - Appendix B - Offsite Sampling Results
 - Part 1: Offsite Analytical Database
 - Part 2: Offsite Analytical Results (Figures)
 - Appendix C - Environmental Screening Level Basis
 - Appendix D - Supplementary Groundwater Information

Subsequently, a revision to the offsite report was issued in August 2009, to include additional sampling data from Runkle Canyon and from the 2007 AREVA survey.

- Boeing, [Offsite Data Evaluation Report Errata Package Cover Letter](#). August 2009. DTSC Source.
- MWH, [Offsite Data Evaluation Report Errata Package](#). August 2009. DTSC Source.
- MWH, [Appendices A through D](#). August 2009. DTSC Source.

Key conclusions of the Offsite Data Evaluation Report are,

- *"The chemical and radiological data were evaluated for significance based on comparisons to residential risk-based or agency-published screening levels. Chemical screening levels for offsite soil, sediment, soil vapor, and bedrock sample concentrations were compared to SSFL RBSLs that have been developed for residential land use according to a DTSC-approved risk assessment methodology. Screening levels for radionuclides in soil were developed using the USEPA PRG based on 10^{-6} excess risk level over background for residential land use. Screening levels for groundwater, spring and seep water, and surface water were all compared to regulatory agency action levels for drinking water concentrations. Each result in the offsite dataset was compared to the media-specific screening level. In evaluation of the offsite data for this report, over 110,000 discrete sample result comparisons were made."*
- *"The offsite sampling results are sufficient with no data gaps identified except in areas of ongoing investigation or cleanup. Offsite data will continue to be supplemented with ongoing sampling programs where appropriate. Onsite data gap analysis is continuing and may also result in additional offsite sampling recommendations."*
- *"The concentrations of chemicals and radionuclides measured in samples collected offsite of the SSFL are not significant in comparison to screening levels except in groundwater north of the main entry gate to the SSFL, and in sediment within the Northern Drainage. These areas are the focus of current and future work, and a remedial cleanup action is currently underway in the Northern Drainage."*



8.15 DTSC Offsite Investigations Overview (2018)

In April 2018 DTSC reviewed all previous offsite sampling investigations and at a public meeting stated,⁴³

- *“Since 1985, multiple chemical and radiological investigations have been conducted at the Santa Susana Field Laboratory (SSFL) and on properties adjoining the site. The investigations included environmental measurements relating to soil, groundwater, surface water, air, and drinking water.”*
- *“DTSC has conducted extensive reviews of the offsite environmental data and studies, including data collected by other government agencies.”*
- *“To date, DTSC has not found any evidence that contamination from research and testing operations at SSFL has posed or would pose a threat to human health or the environment outside the SSFL site boundaries.”*

The Figures 21 and 22 below summarize DTSC’s position on offsite sampling. Notice the similarity between DTSC’s assessment of offsite sampling and that of Boeing ten years earlier.

⁴³ DTSC, “Offsite Investigations Overview”, April 2018. Available at https://www.dtsc-ssfl.com/files/lib_pub_involve/meeting_agendas/meeting_agendas_etc/67734_Update_Regarding_Offsite_Investigations.pdf. Accessed September 5, 2022.



Santa Susana Field Laboratory

Offsite Investigations Overview

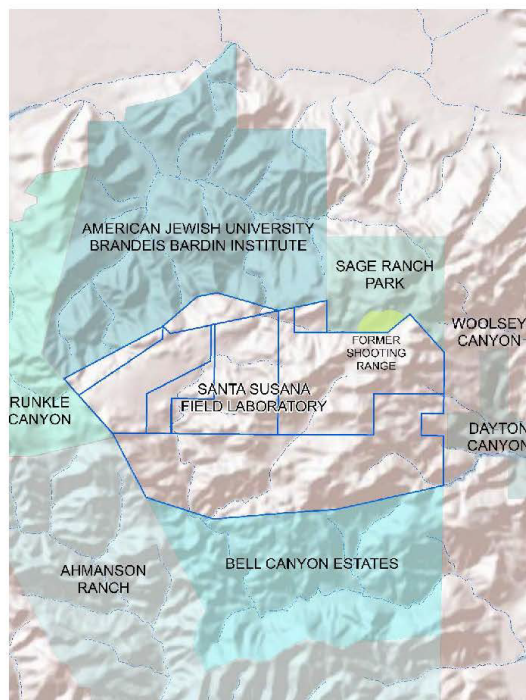
Since 1985, multiple chemical and radiological investigations have been conducted at the Santa Susana Field Laboratory (SSFL) and on properties adjoining the site. The investigations included environmental measurements relating to soil, groundwater, surface water, air, and drinking water.

DTSC has conducted extensive reviews of the offsite environmental data and studies, including data collected by other government agencies.

To date, DTSC has not found any evidence that contamination from research and testing operations at SSFL has posed or would pose a threat to human health or the environment outside the SSFL site boundaries.

Within the site boundaries of SSFL, investigation results indicate areas with contamination above goals protective of human health and the environment. The planned cleanup action will be protective of future users of the site.

There is an ongoing investigation and cleanup of a former recreational shooting range on the Sage Ranch Park Property.



www.dtsc.ca.gov/sitecleanup/Santa_Susana_Field_Lab

Figure 21. DTSC Offsite Investigation Overview ⁴⁴

⁴⁴ DTSC, "Offsite Investigations Overview", April 2018. Available at https://www.dtsc-ssfl.com/files/lib_pub_involve/meeting_agendas/meeting_agendas_etc/67734_Update_Regarding_Offsite_Investigations.pdf#page=1. Accessed September 6, @022.



Summary of Investigations of Surrounding Properties

Brandeis Bardin Institute	<ul style="list-style-type: none"> DTSC prepared a report summarizing investigation work to date in May 2017, concluding no threat from SSFL Surface water discharge regulated by the Los Angeles Regional Water Quality Control Board (LARWQCB) at Outfall 9
Sage Ranch Park	<ul style="list-style-type: none"> Two (2) cleanup actions for lead shot and debris have been performed: <ul style="list-style-type: none"> Northern Drainage Imminent and Substantial Endangerment (2009) – directed by DTSC Interim Source Removal (2011) regulated by the Los Angeles Regional Water Quality Control Board (LARWQCB) Investigation for cleanup of the former Shooting Range is nearly complete, a trail is closed until cleanup is finished DTSC and LARWQCB verifying surface control of the migration of lead shot
Woolsey Canyon	<ul style="list-style-type: none"> Radiological investigations were conducted in 1997 and 2007, and chemical investigations in 2008. <ul style="list-style-type: none"> Results consistent with background
Dayton Canyon	<ul style="list-style-type: none"> Preliminary Endangerment Assessment submitted February 2008, recommending no further action <ul style="list-style-type: none"> DTSC concurred with the no further action recommendation in October 2008 Surface water discharge regulated at Outfall 8 by the LARWQCB Development of residential community in progress
Bell Canyon	<ul style="list-style-type: none"> Bell Canyon investigated in 1998, Buffer zone between operational areas and Bell Canyon investigated in 2017 <ul style="list-style-type: none"> No threat from SSFL identified Surface water discharge regulated by LARWQCB at Outfalls 1, 2, 11, and 19
Ahmanson Ranch	<ul style="list-style-type: none"> Environmental Sampling Report prepared 2000, concludes contamination did not migrate from SSFL <ul style="list-style-type: none"> CA Public Works Board in 2003 acknowledged conclusion satisfies due diligence standard for purchasing the property for use as parkland. Now part of Santa Monica Mountain Conservancy
Runkle Canyon	<ul style="list-style-type: none"> Evaluation Report submitted December 2010, recommending no further action <ul style="list-style-type: none"> DTSC concurred with the no further action recommendation in December 2010 Development of residential community in progress

DTSC Contact

Public Participation Specialist: Michelle Banks-Ordone, (818) 717-6573, Michelle.Banks-Ordone@DTSC.ca.gov

DTSC Technical Documents

DTSC web site: http://www.dtsc.ca.gov/SiteCleanup/Santa_Susana_Field_Lab/ssfl_document_library.cfm

- Go to "Offsite Investigations" then select topic of interest

www.dtsc.ca.gov/sitecleanup/Santa_Susana_Field_Lab

Figure 22. DTSC Summary of Investigations of Surrounding Properties ⁴⁵

⁴⁵ DTSC, "Summary of Investigations of Surrounding Properties", April 2018, Available at https://www.dtsc-ssfl.com/files/lib_pub_involve/meeting_agendas/meeting_agendas_etc/67734_Update_Regarding_Offsite_Investigations.pdf#page=2. Accessed September 6, 2022.



9.0 WORKER HEALTH STUDIES

Although the focus of this paper is to investigate the potential health impact of SSFL operations to the community, it is of value to also present the findings of two major worker health studies. It was judged that studying the potential effect on Rocketdyne workers to radiation and chemicals should also be done. The rationale being that if there was no impact to workers then there was less likelihood of impact to the community and less incentive to conduct more community health studies. In contrast, if there were impacts to workers, there would be more incentive to study potential effects to the community.

Ventura County Star 1997



3

Figure 23. Media Response to the UCLA Rocketdyne Worker Health Study

9.1 UCLA Rocketdyne Worker Health Study - Ionizing Radiation (1997)

The California Public Health Foundation initiated a study of Rocketdyne workers in 1993 to assess the possible health effects of exposure to radiation and chemicals to Rocketdyne workers. Researchers from the UCLA School of Public Health, working with the California Department of Health Services, and funded by the DOE, conducted the study.



UCLA issued the final report of the radiation portion of their study in June 1997.⁴⁶ Principal investigators were Professor Hal Morgenstern, Professor John Froines, Assistant Professor Beate Ritz, and Assistant Researcher Bambi Young.

The DHS issued its own summary of the UCLA report on its website as an HTML page. That statement can no longer be located on the DPH website⁴⁷, though a copy is provided in the footnotes.⁴⁸

The DHS appointed an Advisory Panel co-chaired by Dan Hirsch (Committee to Bridge the Gap) and David Michaels (City University of New York Medical School) and including many other anti-nukers. The Advisory Panel also issued its own interpretation of the UCLA Study, claiming that the results provided evidence that national radiation limits for occupational workers should be lowered.⁴⁹ Interestingly, although the DHS appointed an Advisory Panel, and refers to it as such, that same Panel chose to rename itself as an Oversight Panel, maybe not wishing to be seen as giving advice to the researchers, though undoubtedly it did. A point-by-point rebuttal to the Advisory/Oversight Panel report was prepared by the author.⁵⁰

Boeing enlisted the support of an Expert Review Panel of national experts in the fields of health physics, radiation effects, epidemiology, biostatistics, radiation oncology and public health. The Expert Review Panel assisted Boeing in understanding the data, results, strengths, weaknesses, and conclusions of the UCLA study. These expert reviewers were,

⁴⁶ UCLA, "Epidemiologic Study to Determine Possible Adverse Effects to Rocketdyne/Atomics International Workers from Exposure to Ionizing Radiation", June 1997. Available at https://www.etec.energy.gov/Environmental_and_Health/Documents/WorkerHealthFiles/UCLA_WorkerHealth_Rad.pdf. Accessed August 19, 2022

⁴⁷ The Department of Health Services (DHS) was reorganized July 1, 2007. Public health functions became the new Department of Public Health (DPH) while health care functions became the new Department of Health Care Services (DHCS). July 1, 2007. Available at <https://www.dhcs.ca.gov/formsandpubs/Documents/MMCDAPsandPolicyLetters/APL2007/MMCDAPL07011.pdf>. Accessed August 20, 2022.

⁴⁸ DHS, "Rocketdyne Worker Health Study Summary for Current and Former Rocketdyne/AI Employees", September 1997. https://philrutherford.com/SSFL/RWHS_I/Rad/DHS_Statement.pdf. Accessed August 20, 2022

⁴⁹ Oversight Panel, "Santa Susana Field Laboratory Epidemiological Study: Report of the Oversight Panel", September 1997. Available at https://www.ssflworkgroup.org/files/panel_worker_radiation.pdf. Accessed August 20, 2022.

⁵⁰ Rutherford, "Point-by-Point Rebuttal of the Oversight Panel", September 1997. Available at https://philrutherford.com/SSFL/RWHS_I/Rad/OP_Rebuttal.pdf. Accessed August 29, 2022.



- Harvey Checkoway, Ph.D., M.P.H., Professor of Environmental Health and Epidemiology, and Director of the Environmental Epidemiology Research Core at the University of Washington.
- Michael E. Ginevan, Ph.D., Founding Principal of risksciences.com L.L.C., a consultancy specializing in health risk assessment, scientific databases, and quantitative modeling of environmental problems.
- David M. Gute, Ph.D., M.P.H., Associate Professor of Civil and Environmental Engineering at Tufts University. Former Assistant Commissioner and Director of the Center for Health Promotion and Environmental Disease Prevention, Massachusetts Department of Public Health.
- David G. Hoel, Ph.D., Distinguished University Professor and Chairman of the Department of Biometry and Epidemiology, and Associate Director for Epidemiology of the Hollings Cancer Center at the Medical University of South Carolina. Former Director of the Division of Biometry and Risk Assessment at the National Institute of Environmental Health Sciences at the National Institutes of Health.
- Susan J. Knox, Ph.D., M.D., Professor in the Department of Radiation Oncology at the Stanford University School of Medicine

With the assistance of the Expert Review Panel, Boeing prepared three documents in September 1997. The first “Understanding the Rocketdyne Worker health Study” served as Epidemiology 101 and was intended to familiarize employees with epidemiology, and the various statistical concepts that the UCLA report would be presenting.⁵¹ This was issued shortly before the publication of the UCLA report. The second and third Boeing documents summarized the results, and highlighted the many flaws of the study methodology, data interpretation and conclusions.^{52,53}

In the following months, the author was invited to make two presentations to local professional associations to discuss the UCLA Study. The first was given to the Southern California Chapter

⁵¹ Boeing, “Understanding the Rocketdyne Worker Health Study”, September 1997. Available at https://philrutherford.com/SSFL/RWHS_I/Rad/GUIDE.PDF. Accessed August 29, 2022.

⁵² Boeing, “Presenting the Rocketdyne Worker Health Study”, September 1997. Available at https://www.etec.energy.gov/Environmental_and_Health/Documents/WorkerHealthFiles/whs.pdf. Accessed August 19, 2022

⁵³ Boeing, “Twenty Important Questions About the Worker Health Study and Radiation Activities at Rocketdyne”, Available at https://www.etec.energy.gov/Environmental_and_Health/Documents/WorkerHealthFiles/fctsheet.pdf. Accessed August 19, 2022.



of the Health Physics Society in Los Angeles on October 10, 1997.⁵⁴ The second was given to the Low-Level Radioactive Waste Forum in San Diego on February 11, 1998.⁵⁵

Two years later, in September 1999, the author communicated Boeing's review and concerns to the BEIR VII Committee⁵⁶ some of which is extracted below.⁵⁷

"Many of the BEIR VII Committee will doubtless be familiar with UCLA's conclusions from the Rocketdyne Worker Health Study. UCLA claimed the study showed increased rates of leukemia/lymphoma and lung cancer above 200 mSv (external) and increased rates of leukemia/lymphoma and upper aerodigestive tract cancer above 30 mSv (internal lung dose). The study's authors, the Advisory Panel led by Dan Hirsch, and many other anti-nuclear advocacy groups across the country hailed this as a breakthrough study with important new evidence of the detrimental effects of low-level radiation. Claims were made that the health effects of low-level radiation were 6 to 8 times higher than that suggested by A-bomb survivor data and BEIR V."

"Rocketdyne takes very seriously any health study done on its workers. We believe we have now, and have always, provided a safe workplace for our employees. Nevertheless, as a result of this study we initiated additional medical monitoring, follow-up medical counseling for employees and retirees, and are planning to contract out further, follow-on epidemiology studies."

"However, Rocketdyne, aided by its Expert Review Panel, also had an obligation to its employees to look at UCLA's data, methodology, results and conclusions in an objective, scientific, non-emotional, and non-political manner. What we found was perhaps not surprising. What we found was that few if any of the UCLA's conclusions were actually supported by the data or the results. What we found was that the study raised more questions than it answered. What we found were flaws in methodology and interpretation of data including,

- *Small sample sizes resulting in statistical imprecision*

⁵⁴ Rutherford, "Rocketdyne Worker Health Study", October 9, 1997. Available at https://www.philrutherford.com/Conf_Papers/Epi_scchps.pdf. Accessed August 20, 2022.

⁵⁵ Rutherford, "Rocketdyne Worker Health Study", February 11, 1998. Available at https://www.philrutherford.com/Conf_Papers/Epi_llrwf.pdf. Accessed August 20, 2022.

⁵⁶ The Biological Effects of Ionizing Radiation VII (BEIR VII) Committee convened a public meeting on September 2-3, 1999, at which Dan Hirsch excoriated each and every committee member, accusing them of pro-nuclear bias.

⁵⁷ Rutherford, "Statement to the BEIR VII Committee: Health Risks from Exposure to Low Levels of Ionizing Radiation", September 29, 1999. Available at https://philrutherford.com/SSFL/RWHS_I/Rad/BEIR_VII_Statement.pdf. Accessed August 20, 2022.



- *Selective and inappropriate cancer grouping in order to inflate the cancer rates reported*
- *Double and triple counting of lung cancers and leukemias*
- *Failure to adequately account for confounders such as smoking*
- *Failure to include significant pre Rocketdyne employment exposures*
- *Incorrect calculation of attributable risk*
- *Use of lung dose as a proxy for all other internal organ doses*
- *Contradictory lung cancer conclusions*
- *Data dredging”*

“UCLA’s major conclusions are questionable for the following reasons,

- *UCLA concluded that there was an increased rate of leukemia/lymphoma in those workers with external exposure above 200 mSv (20 rem). This was due to a single (1) leukemia death and a single (1) non-radiosensitive "Hodgkins Disease" death from 34 workers (less than 1% of the cohort) with exposure above 200 mSv (20 rem). The small sample size and inappropriate grouping means that a large uncertainty is associated with this result.*
- *UCLA concluded that there was an increased rate of lung cancer in those workers with external exposure above 200 mSv (20 rem). This was due to 2 lung cancer deaths from 34 workers (less than 1% of the cohort) with exposure above 200 mSv (20 rem). The small sample size means that a large uncertainty is associated with this result. This result was also in direct contradiction to results for internal (inhaled) radiation exposure which showed decreasing lung cancer rates with increasing internal (lung) radiation exposures.*
- *Rocketdyne and many national experts in radiation effects and radiation epidemiology have questioned all UCLA's conclusions based on internal radiation exposure data. UCLA's conclusions are not consistent with what has been seen in a majority of other worker studies that examined higher internal exposures and larger study groups.”*

“The conclusions that are fully supported by the data in the report were,

- *Rocketdyne radiation workers have a 32% lower death rate from "all causes" and a 21% lower death rate from "all cancers" than the U.S. population.*
- *Rocketdyne radiation workers have a 38% lower death rate from "all causes" and an 11% lower death rate from "all cancers" than a similar worker control group who was not exposed to occupational radiation.*
- *The ratio of “all cancer deaths” to “all causes of death” in Rocketdyne radiation workers was 29% compared to 30 % from 1995 U.S. cancer statistics for males over 40.*



- *The ratio of “lung cancer deaths” to “all causes of death” in Rocketdyne radiation workers was 10% compared to 11 % from 1995 U.S. cancer statistics for males over 40.*
- *Out of 4,563 Rocketdyne radiation workers exposed to external radiation, more than 99% (or 4,529) did not exhibit any increased cancer rates due to external radiation.*
- *Rocketdyne radiation workers have received lower exposures than any other groups of radiation workers studied in the U.S., UK, and Canada.”*
- *No Rocketdyne radiation worker has ever exceeded the allowable annual regulatory limits for external radiation exposure.*
- *Since 1984, Rocketdyne has voluntarily limited annual exposures to less than 40% of regulatory limits.*
- *The study demonstrates that Rocketdyne's efforts to minimize exposures and risks to its employees in the area of radiation protection have been successful.*
- *The study demonstrates that there are no widespread health effects related to radiation exposure at Rocketdyne and that its radiation workers are generally healthier than other worker groups.”*

“As would be expected in such a politicized study, the opinions of Rocketdyne's Expert Review Panel were discounted by some as opinions of paid consultants, or “hired guns”. It was therefore very satisfying when, following release of the study, various national experts and national organizations performed completely independent and unsolicited peer reviews of the UCLA study. These included the University of California, Nuclear Regulatory Commission, the Health Physics Society, the Texas State Radiation Advisory Board, the Brookhaven National Laboratory, State University of New York, and Nevada Technical Associates.”

“Taken as a whole, these unsolicited reviews are severely critical of the methodology, analysis, interpretation of data, and conclusions of the study. Peer reviewers are all independent of Rocketdyne Propulsion & Power and independent of The Boeing Company. None have any direct interest in, or are employees of, Rocketdyne or The Boeing Company.”

“These peer reviewers included,

- *Myron Pollycove, Ph.D., M.D., Professor Emeritus of Radiology, University of California at San Francisco. Visiting Medical Fellow, U.S. Nuclear Regulatory Commission.⁵⁸*

⁵⁸ Pollycove, Myron, “Rocketdyne/Atomics International Worker Occupational Study”, December 16, 1997. Available at https://philrutherford.com/SSFL/RWHS_I/Rad/pollycove.pdf. Accessed August 20, 2022.



- *Otto G. Raabe, Ph.D., CHP, Professor and Director of the Institute of Toxicology & Environmental Health, University of California, Davis. President, Health Physics Society (1997-1998).*⁵⁹
- *(The late) Charles Willis CHP, Senior Health Physicist specializing in Epidemiology, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission.*⁶⁰
- *Robert Holloway, Principal, Nevada Technical Associates, providing services in radiation safety training and other related subjects.*⁶¹
- *Michael Ford, CHP, Member of the Texas State Radiation Advisory Board.*
- *Peter Bond, Ph.D., Special Assistant to the Director (1998-Present). Chairman of the Physics Department (1987-1997), Brookhaven National Laboratory.*⁶²
- *Roger Grimson, Ph.D., Associate Professor of Preventive Medicine (specializing in Biostatistics), State University of New York at Stonybrook."*

"Enclosed with this statement are copies of Rocketdyne's response to this study including copies of unsolicited peer reviews. The Rocketdyne Worker Health Study does not provide any new evidence of increased health risks from exposure to low levels of ionizing radiation. We trust that a balanced, scientific, and objective review by the Committee will see past the politics and rhetoric and reach the same conclusion."

9.2 UCLA Rocketdyne Worker Health Study - Selected Chemicals (1999)

In addition to investigation of possible effects of ionizing radiation on Rocketdyne workers UCLA also looked at possible effects of selected chemicals on Rocketdyne workers. UCLA issued its final report in January 1999.⁶³

The Oversight Panel issued its report in April 1999.⁶⁴ Interestingly, the title is "Report of the Oversight Panel Co-Chairs", with the implication that maybe the panel as a whole did not

⁵⁹ Raabe, Otto, "Health Physics Implications of the Rocketdyne Worker Study", June 1998. Available at https://philrutherford.com/SSFL/RWHS_I/Rad/rabbehps.pdf. Accessed August 20, 2022.

⁶⁰ Willis, Charles, "The Rocketdyne/Atoms International Radiation Epidemiology Study", 1998. Available at https://philrutherford.com/SSFL/RWHS_I/Rad/willis.pdf. Accessed August 20, 2022.

⁶¹ Holloway, Robert, "Comments on Caldicott Letter", December 1999. Available at <http://www.ntanet.net/holloway.html>. Accessed August 20, 2022.

⁶² Bond, Peter and Grimson, Roger, "A Note on the 1997 Santa Susana (Rocketdyne) Report", October 1998. Available at https://philrutherford.com/SSFL/RWHS_I/Rad/BOND.pdf. Accessed August 20, 2022.

⁶³ UCLA, "Epidemiologic Study to Determine Possible Adverse Effects to Rocketdyne/Atoms International Works from Exposure to Selected Chemicals", January 1999. Available at https://philrutherford.com/SSFL/RWHS_I/Chem/UCLA_chem.pdf. Accessed August 20, 2022.



participate in the preparation of the report or did not agree with its interpretation or conclusions.

Boeing issued a response⁶⁵ and Q&A⁶⁶ to the UCLA report in April 1999.

9.3 IEI Follow-on Rocketdyne Worker Health Study (2005)

The numerous unanswered questions that the prior UCLA Rocketdyne Worker Health Study raised obligated Boeing to initiate what came to be known as the Rocketdyne Follow-on Worker Health Study.⁶⁷ Boeing teamed with the United Aerospace Workers (UAW) Union in sponsoring this new study. First, Boeing and the UAW selected a Science Committee of outside, independent experts.

- Scott Davis PhD. University of Washington, Fred Hutchinson Cancer Research Center. Epidemiology/Radiation
- John Dement PhD, CIH. Duke University. Industrial Hygiene/Epidemiology
- Karl Kelsey MD. Harvard School of Public Health/Brigham and Womens' Hospital. Cancer/Toxicology
- John Peters MD. USC Keck School of Medicine. Environmental Medicine (Committee Chair)
- Jack Siemiatycki PhD. University of Quebec/Armand Frappier Institute. Epidemiology/Biostatistics
- Laura Welch MD. George Washington University/The Washington Hospital Center. Occupational Medicine/Radiation Epidemiology

The Science Committee reviewed preliminary qualifications from potential bidders and detailed proposals from a short list of qualified candidates and selected the International Epidemiology Institute (IEI). IEI was, and is, a leading epidemiology research organization that works in conjunction with Vanderbilt University, Oak Ridge National Laboratory and Oak Ridge Associated Universities. The team was led by Dr. John Boice. The contract was signed January 2001.

⁶⁴ Oversight Panel Co-Chairs, "Santa Susana Field Laboratory Epidemiological Study, Part II: Exposures to Selected Chemicals. Report of the Oversight Panel Co-Chairs", April 1999. Available at https://www.ssflworkgroup.org/files/panel_worker_chem.pdf. Accessed August 20, 2022.

⁶⁵ Boeing, "The Rocketdyne Worker Health Study", April 1999. https://philrutherford.com/SSFL/RWHS_I/Chem/WHS99.PDF. Accessed August 20, 2022.

⁶⁶ Boeing, "Twenty Important Questions about the Worker Health Study and Chemical Use at the Santa Susana Field Laboratory", April 1999. https://philrutherford.com/SSFL/RWHS_I/Chem/20QUES.PDF. Accessed August 20, 2022.

⁶⁷ Boeing & UAW, "Rocketdyne Follow-on Worker Health Study", October 2001. https://philrutherford.com/SSFL/RWHS_II/FinalWHSIIFactsheet10_01.pdf. Accessed August 20, 2022.



Several areas where the IEI study was an improvement over the UCLA study, was,

- An additional 7 years of follow-on for worker mortality
- Collection of exposure data from pre-employment and post-employment
- Calculation of organ specific internal doses instead of using lung dose as a proxy for all other organs
- Conduct of worker interviews

After four years of research, the IEI Research Team and the Science Committee presented the study results to employees and retirees on April 7-8, 2005.

The IEI Research Team found *"no consistent or credible evidence that employment at Rocketdyne had adversely affected worker mortality."*

The Science Committee likewise concluded that, based on the results of the study,

- *"The Rocketdyne workforce had a much lower overall mortality than the rate observed in the California population."*
- *"There is no evidence that working conditions caused increased mortality in the Rocketdyne workforce."*

Following the release of the IEI results, the author placed all the IEI worker health study documents on Boeing's external website at,

- https://www.boeing.com/aboutus/environment/santa_susana/healthstudy.html,

since the positive conclusions were relevant not only for current Rocketdyne workers but also to Rocketdyne retirees, their families, and neighboring communities. At an unknown time later, all this material was removed during a major website reorganization, and so the link above is no longer available. However a mirror image of this deleted external website can be viewed at ...

- Mirror image of [healthstudy.html](#). Author Source.

Currently the only reference to this groundbreaking study on the current Boeing SSFL website is a link to the 53-page executive summary on the DOE ETEC website. To rectify this situation, the complete IEI Rocketdyne Worker Health Study results are provided below. Author Source.

- Boeing, [Understanding the Rocketdyne Follow-on Worker Health Study](#), March 2005. An explanation of the epidemiological study, how it is performed, and what the data means.
- Boeing, [Interpreting the Rocketdyne Follow-on Worker Health Study](#), April 2005. A discussion of the results and conclusions of the study in simple non-scientific terms.



- Science Committee, [Science Committee Summary](#), March 19, 2005.
A summary of the key results and conclusions, written by the Science Committee, who oversaw the design and performance of the study.
- John Boice, [Presentation Materials](#), April 6-7, 2005.
PowerPoint charts of the presentation given by John Boice of IEI to Rocketdyne employees and retirees on April 6th and 7th, 2005.
- John Boice, [Presentation Video](#), April 7, 2005.
Video of the presentation given by John Boice of IEI to Rocketdyne employees on April 7th, 2005. Poor video quality makes it difficult to read details of the slides. It is recommended to read the above PowerPoint charts coincident with viewing the video.
- [Rocketdyne Worker Health Study Final Report](#) (Complete Report)
 - [Executive Summary](#)
 - [Appendices](#)
 - [A. Analyses of All Rocketdyne Workers Combined](#)
 - [B. Miscellaneous Study Topics](#)
 - [C. Tobacco Use, Smoking Survey](#)
 - [D. Comparisons with Previous Investigations by UCLA](#)
 - [E. Databases Used During the Conduct of Study](#)
 - [F. Glossary of Terms](#)
 - [G. Study Brochure \(October 2001\)](#)
 - [H. Responses to Issues Raised by Science Committee](#)
 - [I. Institutional Review Board and Other Human Subjects Committee Approvals](#)
- [Biographies of the IEI Research Team](#)
- [Biographies of the Science Committee](#)
- Papers in peer reviewed journals
 - [Mortality Among Rocketdyne/Atomics International Workers Monitored for Radiation 1949-1999](#) (Courtesy of the Journal of Radiation Research)
 - [Mortality Among Rocketdyne Workers Who Tested Rocket Engines, 1948-1999](#) (Courtesy of the Journal of Occupational and Environmental Medicine)
 - [A Comprehensive Dose Reconstruction Methodology for Former Radiation Workers](#) (Courtesy of the Journal of the Health Physics Society)
 - [A Respiratory Model for Uranium Aluminide Based on Occupational Data](#) (Courtesy of the Journal of Radiological Protection)



10.0 COMMUNITY HEALTH STUDIES

The conduct of epidemiology studies is such that the investigator looks for “links” from an agent (occupational or environmental exposures) to a health effect (e.g. cancer or other illnesses). A layperson may think in terms of “cause and effect” or a “correlation” between exposure and health impact. Epidemiologists however needed to invent their own language. You will never see the words “cause and effect” or “correlation” in their reports. Epidemiologists use the term “association” to describe an apparent relationship between exposure and health impact. There are several reasons for this.

Firstly, in the case of a community study, the hypothetical exposures are unknown, and distance from an exposure source is used as an imperfect proxy for a presumed magnitude of exposure ... the closer the distance to the source, the larger the presumed exposure.

Secondly, and more importantly, “ecological” community epidemiology studies look at groups of people (e.g. census tracts) and “health outcomes” within census tracts. Hence, “associations” are sought between unknown exposures and loosely related population groups. In radiation worker epidemiology studies, individuals have known measured external and internal exposures and a specific known illness. Individuals with known exposure and known illness are assigned to exposure categories, therefore more quantitative and meaningful dose-effect relationships can be developed. No such “cause and effect” quantification is possible with the typical “ecological” community cancer registry studies described below.

Thirdly, to complicate matters even further, epidemiology study results are reported with 95% confidence interval (CI) reflecting the fact that the expected rate ratio has an inherent error associated with it. If the number of cases (e.g. cancer cases) in a cohort (census tract) is small, then the confidence bounds are large implying a large error in the estimated rate ratio. Thus a rate ratio of 60% higher than expected may be significant or not depending on the confidence intervals. For instance, 1.6 (CI = 1.4, 1.8) is statistically significant, but 1.6 (CI = 0.6, 2.6) is not statistically significant since the confidence interval includes the null value of 1.0.

Finally, most epidemiologists like to see a statistically significant rate ratio of ≥ 2.0 before they will even consider the possibility of a potential association. This has a corollary in the legal profession.

There are two burdens of proof in the legal system, “preponderance of evidence” and “beyond a reasonable doubt.”



“Preponderance of evidence”⁶⁸ applies in civil trials and requires that the plaintiff proves that there is a greater than a 50% chance that the claim is true. This burden of proof is also known as “at least as likely as not” and only requires that the plaintiff’s claim is slightly more likely (or credible) than the defendant’s opposition.

In contrast, “beyond a reasonable doubt”⁶⁹ applies to criminal trials where issues of life or liberty are at issue. This higher burden of proof requires that the prosecution has to prove that there is no other reasonable explanation based on the evidence that the defendant is guilty. In other words, the jury must be virtually certain of the defendant’s guilt in order to render a guilty verdict. This is a much higher standard or burden of prove than “preponderance of evidence” that only requires a 50% certainty.

One might expect that the “beyond a reasonable doubt “ would also have a numerical probability assigned to it. However courts have been reluctant to assign such a value, not wishing to quantify “reasonable.” However, scientists and engineers would likely use >90% or >95% as a criterion for “beyond a reasonable doubt.”

These established legal burdens of proof serve as precedent for two compensation programs, offered by the federal government. The first, the Energy Employees Occupational Illness Compensation Program (EEOICPA) provides compensation to DOE employees and contractors who have become sick because of exposure to toxic chemical or radioactive materials in the workplace.^{70,71}

In the EEOICPA program, if NIOSH can prove from exposure records and medical records that a claimant’s illness is “at least as likely as not” caused by workplace exposures, then the claimant will receive compensation. In mathematical terms, this means that the calculated “probability

⁶⁸ Cornell Law School, “Preponderance of Evidence.” Available at https://www.law.cornell.edu/wex/preponderance_of_the_evidence#:~:text=Preponderance%20of%20the%20evidence%20is,that%20the%20claim%20is%20true. Accessed October 22, 2022.

⁶⁹ Cornell Law School, “Beyond a Reasonable Doubt.” Available at https://www.law.cornell.edu/wex/beyond_a_reasonable_doubt. Accessed October 22, 2022.

⁷⁰ DOE, Energy Employees Occupational Illness Compensation Program.” Available at <https://www.energy.gov/ehss/energy-employees-occupational-illness-compensation-program>. Accessed October 22, 2022.

⁷¹ DOL, “Energy Workers Program.” Available at <https://www.dol.gov/agencies/owcp/energy>. Accessed October 22, 2022.



of causation (PC)” is greater than 50%.⁷² Although the EEOICPA claims program is not civil litigation, this criterion is the lowest standard or burden of proof used in civil courts.

The second federal compensation program, run by the U.S. Department of Veterans Affairs, also uses the “as least as likely as not” burden of proof that there is a 50% or greater likelihood that his/her disability was caused or aggravated by his/her military service in order to get disability benefits.⁷³

Making an analogy between DOE workers’ compensation and community cancer registry studies.

- Probability of causation (PC) for DOE workers = 50% = 0.5 = $\frac{DOE_w}{DOE_w + Base}$.
- Where DOE_w = Risk of contracting cancer due to workplace exposures at a DOE facility
Base = Risk of contracting cancer outside the workplace
- Probability of causation (PC) for SSFL neighbors = 50% = 0.5 = $\frac{SSFL}{SSFL + Base}$
- Where SSFL = Risk of contracting cancer due to offsite exposures from SSFL
Base = Risk of contracting cancer as a county resident far distant from SSFL
- When and only when SSFL = Base
- Therefore, Risk (Rate) Ratio = $\frac{SSFL + Base}{Base} = 2.0$

Therefore, a probability of causation of 0.5 or 50%, is equivalent to the lowest legal burden of proof, a “preponderance of evidence” or “at least as likely as not” and is equivalent to a risk ratio or rate ratio of 2.0.

Clearly, therefore a rate ratio of ≥ 1.5 that Dr. Morgenstern (Section 10.6) appears to favor as a red flag, would not pass the burden of proof in a civil court and would definitely not pass the burden of proof in a criminal court which would require a 90% to 95% probability of causation or a rate ratio of 10 to 20.

⁷² CDC-NIOSH, “Calculating Probability of Causation”, Page last reviewed June 30 , 2022.
<https://www.cdc.gov/niosh/ocas/pccalc.html>. Accessed August 20, 2022.

⁷³ Veterans Law Office, “What is the “At least As Likely As Not” Standard in VA Disability Law”,
<https://veteranslawoffice.com/what-is-the-at-least-as-likely-as-not-standard-in-va-disability-law/>. Accessed August 20, 2022.



10.1 Department of Health Services

The California Department of Health Services conducted two cancer registry studies of census tracts neighboring SSFL in the early 1990s.

10.1.1 Department of Health Services (1990)

In October 1990, Robert Holtzer of the DHS Environmental Epidemiology and Toxicology Branch released a cancer registry analysis of five census tracts surrounding SSFL. Dr. Holtzer had requested this study by the Cancer Surveillance Section, though it is uncertain who suggested it to Dr. Holtzer. SSFL is not explicitly named in the study, only referred to as a “hazardous waste site.”

- DHS, [Cancer Incidence Rates in Five Los Angeles County Census Tracts](#), October 10, 1990. DOE Source.

The study conclusions were,

- *“Given the large number of comparisons made (five census tracts, two time periods, eleven sites(cancers), these findings are consistent with random variation in cancer incidence rates.”*
- *“Among the cancer sites examined, only bladder cancer shows any suggestion of an elevation in the census tracts of interest compared to rates in the county as a whole.”*
- *“It should also be noted that bladder cancer rates vary considerably by gender and race/ethnicity ... whites are approximately two times as more likely to die of bladder cancer than Hispanics.” :Therefore, some of the elevation in bladder cancer incidence can probably be explained by the larger proportion of whites in these census tracts.”*

Notwithstanding the cautionary statements in the study, the “suggestion of an elevation” in bladder cancer hit the media headlines.

The recommendations of the investigators were to expand the study to Ventura County census tracts, include more time periods and refine the study by looking at age-adjusted race and gender specific incidence rates. These recommendations were implemented in the following DHS study two years later

10.1.2 Department of Health Services (1992)

The second DHS cancer registry study was released in March 1992.

- DHS, [Cancer Incidence Near the Santa Susana Field Laboratory \(1978-1989\)](#), March 27, 1992. DOE Source



This time SSFL was explicitly identified in the study title. It also became clear that the community's and activists' focus was on perceived health impacts of radiation, not chemicals, as the following quotes from the 1992 report illustrate ...

- *"This (prior 1990) work was done in response to community concerns regarding cancer risks which may have resulted from the presence of radioactive materials on the SSFL site."*
- *"Specific objectives of these follow-up [1992] analyses are ... evaluate relative incidence of bladder cancer, and other possibly radiogenic cancers ... analyze cancers not included in the preliminary report (such as breast cancer) for which there is some evidence of radiation-related risks."*
- *"Because initial public concerns were prompted by the presence of radioactive substances on the SSFL site, cancers were grouped based on the evidence for radiogenic causes ..."*

Clearly radiation was in the crosshairs rather than chemicals. However, the report's conclusions, highlighted below, suggest exactly the opposite, that radiation did not have an impact on cancer rates in the community. A finding that must have annoyed many, but was ignored by the media.

The **Executive Summery, Results and Conclusions** are given here in their entirety.

- **"Results"**
- *"Very radiosensitive cancers were not more common among residents near the SSFL in any of the time periods examined or geographical comparisons made. Somewhat higher and somewhat lower incidence of some cancer types was seen among residents near SSFL, but there was no consistent pattern between residents of the two counties, or between men and women. The rate of bladder cancer was higher in 1983-88 among men, but not women. who lived in Los Angeles County near the SSFL than in the County as a whole. It was not higher in the earlier time period (1978-82). Comparing the two counties during 1988-89, the proportional incidence of bladder cancer was somewhat higher among Los Angeles County residents living near SSFL, but somewhat lower among nearby Ventura County residents."*
- *"Men living near the SSFL in Ventura County had a higher proportion of lung cancers than men living elsewhere in the County, but women did not, nor did either men or women near the site in Los Angeles County. Cases of all types of cancer for which radiation may be one cause were somewhat more common among men living near the SSFL in both counties but were not more common among women living in either county."*
- *"All epidemiology studies have some limitations. For these analyses, there was not information on length of residence near SSFL, nor on people who once lived nearby but were diagnosed with cancer after moving away. Environmental, occupational and*



lifestyle factors among the individuals with cancer were also unavailable. The relatively small number of cancer in the five-mile radius during the years examined also limits the ability to find risks that may exist. These limitations should be kept in mind, but do not change the overall conclusions of the report.

- **“Conclusions”**
- *“These follow-up analyses suggest that people living near the SSFL are not at increased risk for developing cancers associated with radiation exposure. The findings are consistent with the earlier DHS report that indicated an increase in the incidence of bladder cancer in people living in Los Angeles County near the SSFL, although this increase appears to be restricted to men in Los Angeles County only. There is also an increased proportion of lung cancer among Ventura County men [but not in Ventura County women or Los Angeles County men or women]. Lack of an increase in the most radiosensitive cancers suggests causes other than radiation. Because lung and bladder cancers tend to be cancers that are strongly associated with other factors (smoking and non-radiation occupational exposures), it is important to consider these alternative explanations when initiating the DOE-sponsored worker health study among Rocketdyne employees.”*

The report’s **Summary Findings** reiterate its conclusions.

- *“These follow-up analyses suggest that people living near the SSFL are not at increased risk for developing cancers associated with radiation exposure.” Page 6.*
- *“Although some specific comparisons are statistically significant, the pattern of the elevations is not consistent with a community-wide environmental exposure to radiation.” Page 6.*
- *“**Very Radiosensitive Cancers** [thyroid, bone and leukemias except CLL]: There is no evidence to suggest that those types of cancer that would most likely to have radiation exposure as a major contributing cause occurred more commonly among residents in either Ventura or Los Angeles County who live near the SSFL.” “These data suggest that, if anything, the incidence of these cancers may actually have been lower among people living near SSFL during the years covered. Page 7.*
- *“**Moderately Radiosensitive Cancers** [lung and female breast]: Cancers of the female breast appeared to have occurred among women living near the SSFL, at the same rate, and in the same proportion, as these cancers occurring among non-Hispanic women elsewhere in Ventura and Los Angeles. For cancers of the lung, the pattern of occurrence was inconsistent.”” Page 7.*
- *“**Possibly Radiosensitive Cancers** [stomach, esophagus, liver, brain, bladder, other urinary organs, parathyroid, salivary gland, and multiple myeloma]: The majority of the increased rate in [the group of] possible radiogenic cancers among these men [non-Hispanic White men in Los Angeles County] appears to be associated with a non-*



significant elevation in bladder cancer, which accounts for the majority of possibly radiogenic cancers ... neither of these associations is statistically significant. However, among non-Hispanic Whites in Ventura County, bladder cancer occurs proportionately less often among men and women who live in the area close to SSFL than in the rest of the county, and there is no elevation in the proportion of possibly radiogenic cancers as a group.” Pages 7 & 8.

- *“We would expect that if the community exposure to ionizing radiation were causing an elevation in cancers in this geographic area we would see the greatest increase among those cancers known to be most strongly associated with radiation exposure. Not only is such a pattern not evident, but the very radiosensitive cancer group appears to be somewhat underrepresented among people living near the SSFL.”* Page 8.

I think it is safe to say that this 1992 study put the nail in the coffin of radiation generated cancers and bladder cancer.

10.1.3 Commentary on the DHS Studies

During the period following the release of the DHS studies, the author communicated with DHS management (Ed Bailey, Peggy Reynolds, and Bob Harrison) about flawed statistics in both studies. DHS had used a Poisson approximation for its evaluation of the standard deviation of the LA and Ventura countywide cancer rates.⁷⁴ If the true empirical standard deviation had been calculated from the known rates of all county census tracts, the 95% confidence level of the county rates would have been far larger and the 95% confidence levels of the SSFL census tract rate ratios would also have been far larger and would have included the null value of 1.0. Census tract rate ratios would therefore have all been statistically insignificant.

This flawed statistics was intuitively obvious in the first study. Even though the census tract 1132 was identified as being in the upper quartile for bladder cancer, 20% of LA County census tracts had higher bladder cancer rates than census tract 1132.⁷⁵ This did not meet the typical 95% upper bound, commonly used to determine if a data point is part of a distribution. The following discusses the flawed analysis in more detail.

- Rutherford/Boeing, [Summary of State Cancer Studies](#), Author Source.

10.2 Tri-Counties Regional Cancer Registry (1997)

In September 1997, the Tri-Counties Regional Cancer Registry released results of a new study.

⁷⁴ The 1990 DHS study stated in its summary, “Statistical significance was approximated by using the Poisson distribution.”

⁷⁵ The author and his family have lived in census tract 1132 for 34 years.



- Letter from K. Nasser (Tri-Counties) to P. Lorenz (Ventura County Public Health), [Untitled](#), September 29, 1997. DOE Source.

The letter concluded, *"My conclusion from this simple preliminary analysis is that residents of the study area seem to have cancer incidence risk which is similar to that of the other residents of the Tri-Counties region, except for leukemia in women which is significantly lower, and cancer of the lung & bronchus which is higher."*

10.2.1 Commentary on the Nasser Study (1997)

The Nasser Study claimed an apparent higher rate for lung cancer. However, a 1.17-fold or 17% difference in lung cancer cases is not remarkable or statistically significant. The results are lacking the usual 95% confidence bounds usually assigned to rate ratios. Simply giving observed and expected cancers provides no information the uncertainty of the numbers.

Like the prior two State cancer studies, inspection of the observed lung cancer incidence rates for each of the census tracts in the Tri-Counties area, will indicate a wide range of results and the SSFL census tracts incidence rates fall within that range. Indeed Dr. Peggy Reynolds, of the DHS Environmental Health Investigations Branch, author of the 1992 State cancer study observed that between 200-300 census tracts in the Los Angeles region had lung cancer rates that exceeded the expected rate by 17% or more. Hence a 17% higher rate is not statistically significant.

In item 5 on page 2 of the report, the study author cautions that there is no adjustment for population growth during 1991 through 1995. He therefore acknowledges that the expected numbers are underestimated. If these expected numbers were corrected, then the 261 expected lung cancers would be much closer to the 306 observed lung cancers.

If a population correction were to be applied, then the study's conclusion that *"... residents of the study area seem to have cancer incidence risk which is similar to that of the other residents of the Tri-Counties region ..."* would apply to all cancers investigated. It is also worth noting that other cancers that have been the focus in recent studies, such as leukemia and bladder cancer, are not elevated in this study.

10.3 Department of Toxic Substances Control (1999)

10.3.1 Rocketdyne Inquiry (1999)

In October 1999, following the urging of Assemblymember Sheila Kuehl, the DTSC conducted an internal inquiry into the California Department of Health Services. Such an inquiry by one California agency into the ethics of a sister agency was unprecedented, and only goes to show



the insidious power of the Hirsch/Kuehl partnership to generate a “mountain out of a molehill” about what turned out to be a “storm in a teacup.”⁷⁶

- DTSC, [Rocketdyne Inquiry - Summary of Findings and Report](#), August 1999. DOE Source.

Note that the title is misleading in that it was an inquiry into the actions of DHS not of Rocketdyne.

The following provides relevant summary extracts from the DTSC’s 32-page report.

- *“Governor Gray Davis, in letter dated May 3, 1999, directed California Environmental Protection Agency (CalEPA) Secretary Winston Hickox to conduct an independent investigation of allegations that California Department of Health Services (DHS) personnel improperly withheld a 1997 cancer registry study of communities within Los Angeles County⁷⁷ near the Rocketdyne Santa Susana Field Laboratory (SSFL) test site.”*
- *“The allegations were raised by Assemblymember Sheila Kuehl in a letter dated April 13, 1999, to Health and Human Services (DHHS) Secretary Grantland Johnson. The CalEPA Secretary asked that the inquiry respond to Secretary Johnson’s request for a “thorough and independent review of Assemblyperson Sheila Kuehl’s concerns ...”*

A key question from Ms. Kuehl was,

- *“Did DHS personnel suppress or withhold a September 1997 Tri-Counties cancer registry analysis (1997 Nasser report) from investigators employed in UCLA worker health studies or the worker health Advisory Panel engaged in oversight activity?”*

To which the report answered,

- *“There appears to have been no intent by DHS staff to suppress or withhold the 1997 Nasser report. The DHS Cancer Surveillance Section properly followed its own guidelines in receiving and considering the 1997 Nasser Report. The DHS Cancer Surveillance Section failed, however, to take further action as required for “unusual aggregations of cancers” because the medical epidemiologists in the DHS Cancer Surveillance Section and the Environmental Health Investigations Branch did not believe the results were significant or unusual. Although the scientific evidence is not entirely clear, the weight of DHS epidemiological opinion and independent epidemiological evaluation by DTSC staff supports the conclusion that the 1997 Nasser report did not disclose an unusual cancer aggregation.”*

⁷⁶ Apologies for mixing metaphors.

⁷⁷ Note that reference to Los Angeles County was in error. The Nasser study only included census tracts near SSFL in Ventura County.



10.3.2 DTSC Expert Panel Review (1999)

As part of DTSC's Inquiry, it hired an expert panel to review the previous two DHS studies and the Nasser Study. The Panel consisted of Dr. Myrto Petreas (DTSC), Dr. James Beaumont (UC Davis) and Dr. Faith Davis (UI, Chicago). The expert panel report was released in June 1999.

- Petreas, Myrto, [Health Studies at Santa Susana Field Laboratory – Expert Panel Review](#), June 20, 1999. DOE Source.

The panel concluded,

- *"Whereas there were some differences in the geographic areas, time periods, case definitions, and level of significance used in these three studies, the combined evidence from all three does not indicate an increased rate of cancer incidence in the regions examined."*
- *"The results do not support the presence of any major environmental hazard."*

10.3.3 Commentary on the DTSC Inquiry (1999)

Boeing prepared a summary of the Inquiry's conclusions.

- Rutherford/Boeing, [DTSC Inquiry of DHS](#), September 1, 1999. Author Source.

10.4 Retinoblastoma (2005-2007)

In 2005, childhood retinoblastoma became an issue with the allegation that these childhood cancers were rampant in Calabasas and Woodland Hills, near the SSFL. Note that these cancers had never been discussed in prior cancer registry studies for the simple reason that numbers had been so low as not to have been worthy of mention.

10.4.1 USC Cancer Surveillance Program (2005)

In July 2005, Dr. Wendy Cozen of the University of Southern California Cancer Surveillance Program issued results of a study.

- Cozen, [Community Cancer Assessment Regarding Retinoblastoma in the West Valley. Los Angeles County](#), July 20, 2005. Author Source.

Dr. Cozen concluded,

- *"We conclude there is no evidence to support an excess of retinoblastoma in the West Valley and there is no biologically plausible environmental exposure that would produce such a cluster."*



10.4.2 DHS Cancer Surveillance Center (2007)

In October 2007, the Cancer Surveillance Center of the Department of Public Health conducted a review of retinoblastoma incidence in the communities surrounding SSFL. This was in response to a request by State Senator Sheila Kuehl (notice a pattern here?). The California Cancer Registry (CCR) research staff developed an analysis plan in consultation with Dr. Hal Morgenstern, an epidemiologist at the University of Michigan with an interest in this topic (i.e. SSFL).

- California Cancer Registry, [Evaluation of Retinoblastoma Incidence in Children in Los Angeles and Ventura Counties](#). October 1, 2007, Author Source

The study concluded,

- *"In conclusion, incidence of retinoblastoma among children under age 5 residing in the area around the SSFL between 1988 and 2005 was slightly, although not statistically significantly, higher than expected based on incidence statewide. The relatively young age of the cases, and the high proportion of cases with bilateral disease, is suggestive of a genetic origin. This analysis is consistent with the 2005 report that showed no significant increased risk of retinoblastoma between 1972 and 2002."*

Subsequently, Dr. Hal Morgenstern issued a critique of the State study,

- Letter from Hal Morgenstern to Senator Kuehl, [Evaluation of Retinoblastoma Incidence in Children in Los Angeles and Ventura Counties. Report of the California Cancer Registry to Senator Kuehl](#). December 10, 2007. Author Source.

Dr. Morgenstern concluded,

- *"I believe the CCR report is poorly documented, the findings are inappropriately interpreted, and the authors have not pointed out the limitations of their methods. The analysis conducted by the CCR researchers is a useful first step, but the findings should not be interpreted to mean that the observed cases of retinoblastoma were random occurrences or that they were not influenced by environmental factors."*

If the CCR report shown above is complete, then I would agree with the comment that it is poorly documented. It appears to be an incomplete draft with no agency header. There is reference to an attached map that is missing. What else is missing? Finally, it is not obvious who authored this report. Was it the Cancer Surveillance Center of the Department of Public Health, or was it the California Cancer Registry?



10.5 Public Health Institute (2006)

In October 2006, the [Public Health Institute](#), using data from the Tri-Counties Cancer Surveillance Program, conducted a study of census tract 75.03, encompassing a 2- to 3-mile radius surrounding SSFL in Ventura County. The study was conducted in response to a letter from a local resident who was concerned over media reports suggesting *“possible increase in cancer rates due to the melt down of the reactor at SSFL in 1959.”*⁷⁸ This, of course, referred to the discredited Hirsch-led Advisory Panel reports discussed in [Section 11.2](#). This PHI study was conducted by Dr. Kiumarss Nasser, who had conducted the 1997 study (Section 10.2) that was the subject of the DTSC inquiry of DHS ([Section 10.3](#)).

- [Letter from K. Nasser \(Public Health Institute\), Untitled](#), October 10, 2006. DOE Source.

The conclusion of the study is,

- *“Based on this analysis, I conclude that occurrence of newly diagnosed invasive cancers in census tract 75.03 in Ventura County, does not show any unusual pattern and has actually decreased by 7.5 percent from 1988 through 2004.”*

10.6 Morgenstern Community Cancer Study (2006-2007)

In 1999 the Agency for Toxic Substances Disease Registry (ATSDR) conducted a preliminary site evaluation (review of SSFL operations and records) and concluded, that ...

- *“In this preliminary evaluation of available data and information, ATSDR has not identified an apparent public health hazard to the surrounding communities because people have not been, and are currently not being, exposed to chemicals and radionuclides from the site at levels that are likely to result in adverse health effects.”*

Nevertheless, ATSDR recommended several further studies including an update of the prior state cancer registry studies.

Subsequently, ATSDR contracted with the Eastern Research Group (ERG), who in turn issued a sole source contract to the University of California at Los Angeles (UCLA) to perform these tasks. Why was the contract sole source?⁷⁹ Dr. Hal Morgenstern was assigned lead investigator for the community cancer study. Was his choice as principal investigator politically motivated because he had performed the first Rocketdyne Worker Health Study? He soon left UCLA to head the Epidemiology Department at the University of Michigan but continued his work there.

⁷⁸ Los Angeles Times, “Study Says Lab Meltdown Caused Cancer”, October 6, 2006.

⁷⁹ The choice of IEI for the Follow-on Rocketdyne Worker Health Study followed a competitive bid process overseen by an independent Science Committee with no input from Boeing.



In February 2006, preliminary results of the community cancer study were presented to the public during a SSFL Work Group meeting.

- Morgenstern, [Cancer Incidence Surrounding the Rocketdyne Facility in Southern California: Interim Report](#), February 2, 2006. Author Source.

Results for age and sex adjusted rate ratios for specific cancer sites, groupings of radiosensitive, chemo-sensitive and all cancers appeared to suggest a generally flat dose response (using distance a proxy for dose) for non-Hispanic whites, the predominant ethnic group in the locations investigated. In contrast, similar data for Hispanics appeared to suggest a positive dose response or increasing rate ratios the closer to SSFL they lived (See charts 24 to 32).

In his summary Dr. Morgenstern stated,

- *"Increased rates close to SSFL are mostly limited to Hispanic residents."*

Dr. Morgenstern was unable to explain this apparent preferential ethnic difference for implied radiation or chemical exposure.

In March 2007, Dr. Morgenstern issued his community cancer study.

- Morgenstern, [Cancer Incidence in the Community Surrounding the Rocketdyne Facility in Southern California](#), March 2007. DOE Source.

The conclusions of the study were ...

- **"Results:** Associations between distance from SSFL and cancer incidence differed by type of cancer outcome. Standardized incidence rate ratios were close to 1, indicating little or no association, for total cancers and radiosensitive cancers among adults; but the incidence rate of chemo-sensitive cancers was slightly elevated during both follow-up periods in the population living within 2 miles of SSFL. Results for the 9 specific cancers revealed some elevated incidence rates between 1988 and 1995 among persons living within 2 miles of SSFL. Specifically, the standardized incidence rate ratio was greater than 1.6 for cancers of blood and lymph tissue, bladder, thyroid, and upper aerodigestive tract. Between 1996 and 2002, the rate ratio among persons living within 2 miles of SSFL was greater than 1.6 for thyroid cancer. There were too few childhood cancers to yield informative results."
- **"Discussion:** The strongest and most consistent association observed in this study was for thyroid cancer, which was associated with distance from SSFL in both follow-up periods. This finding may have public-health significance because perchlorate, a component of rocket fuel used in large quantities at SSFL, is known to disrupt thyroid function, it has been shown to induce thyroid tumors in laboratory animals, and there is



evidence from two other investigations that perchlorate migrated offsite to contaminate the groundwater in areas surrounding SSFL. In addition, findings from one of those other studies suggest that the 1959 partial meltdown of a nuclear reactor at SSFL could have released appreciable amounts of radioactive cesium and iodine, which might have increased the incidence of thyroid cancer in the population surrounding SSFL. Furthermore, our results for cancers of the bladder, blood and lymph tissue, and upper aero-digestive tract are consistent with associations observed in the UCLA Worker Study between mortality from these cancers and occupational exposures to radiation and chemicals."

- *"It is important to recognize that associations observed between distance from SSFL and the incidence of specific cancers are based on small numbers of cases in the region closest to SSFL. Thus, these associations are estimated imprecisely and may represent chance findings. In addition, observed associations may have been biased by certain methodologic limitations—use of distance from SSFL as a crude proxy measure for environmental exposures, mobility of the residential population before and during the follow-up period, and lack of information on other cancer risk factors, such as cigarette smoking and socioeconomic status, that might distort the observed associations."*
- **"Conclusion:** *Despite the methodologic limitations of this study, the findings suggest there may be elevated incidence rates of certain cancers near SSFL that have been linked in previous studies with hazardous substances used at Rocketdyne, some of which have been observed or projected to exist offsite. There is no direct evidence from this investigation, however, that these observed associations reflect the effects of environmental exposures originating at SSFL. Given these provocative findings and unanswered questions, it is tempting to recommend further analyses or future studies to address the health concerns of the community. Unfortunately, it is not clear at this time whether such additional analyses or studies will be sufficient to determine whether operations and activities at Rocketdyne affected, or will affect, the risk of cancer in the surrounding neighborhoods."*

Dr. Morgenstern attempts to correlate his questionable results to alleged offsite exposures from the Advisory Panel reports on the SRE accident, the UCLA Cohen Exposure Assessment, and his Rocketdyne Worker Health Study. These correlations lack credibility, given Boeing's vigorous discrediting of these studies in [Section 11.2](#), [Section 11.3](#), [Section 9.1](#) and [Section 9.2](#).

To the author's knowledge, neither the ATSDR, the sponsor of the Morgenstern Study, nor ERG, its funding source, have made any written public statement supporting this study.

Unlike Boeing's public rebuttal to these other studies, Boeing chose not to publish contemporaneous critiques of Dr. Morgenstern's study, judging that the report's data, results and conclusions were relatively benign. That was probably a mistake, given the amount of attention that the Morgenstern study ultimately received. Nevertheless, three peer reviews



were made of the Morgenstern Study immediately following its publication. These are published here for the first time.

10.6.1 Boeing Response to the Morgenstern Study (2007)

Boeing reviewed the Morgenstern Study.

- Rutherford/Boeing, [Boeing Response to the Report “Cancer Incidence in the Community Surrounding the Rocketdyne Facility in Southern California](#), March 26, 2007, Revised May 28, 2009. Author Source.

Key take-aways from Morgenstern’s study are,

- Cancer rates were sliced and diced 206 different ways
 - All cancers combined, radiosensitive and chemo-sensitive
 - Two time periods
 - Two distances
 - By gender
 - By ethnic origin, hispanic, non-hispanic white, and other non-hispanic white
 - Nine specific cancers
- Almost as many rates were less than 1.0 as greater than 1.0
- More rates were significantly less than 1.0 than significantly greater than 1.0
- Morgenstern stated there was little or no increased rates for “all cancers” or radiosensitive cancers There was a slight increase for chemo-sensitive cancers
- Ethnic breakdown generally indicated that only Hispanic rates were greater than 1.0. All other races were generally less than 1.0
- Of the 36 separate specific cancer rates calculated, only 5 warranted any comment by Morgenstern as elevated, and even these were not statistically significant
- Morgenstern stated that these 5 elevated rates were due to small numbers and may represent chance findings
- Morgenstern stated that there is no direct evidence from his investigation that the observed associations reflect the effects of environmental exposures originating from SSFL

10.6.2 Warren Comments on the Morgenstern Study (2007)

Boeing commissioned Dr. Alan Warren to review the Morgenstern study. Dr. Warren is Program Director of Environmental Health Science at the University of South Carolina, Beaufort. Dr. Warren had also reviewed the Cohen Exposure Study in 2006.

- Warren, [Summary Comment Letter on the Study entitled, Cancer Incidence in the Community Surrounding the Rocketdyne Facility in Southern California](#), Highlighted version. March 22, 2007. Author Source.



This paper usually highlights several important conclusions from each cited study. However, Dr. Warren's review was so replete with criticisms of the Morgenstern study that the above linked copy of Warren's review is a highlighted version. Some key comments by Dr. Warren confirm identical comments by the author,

- *"... the large number of significantly elevated and reduced rate ratios largely reflects the extremely narrow theoretical confidence limits calculated for the referent group, rather than considerable differences in incidence rates between proxy measures of exposure. Such narrow confidence limits obviously fail to reflect the true variability in baseline cancer rates and thus contribute to the study's misinterpretation."* (Confirms author's comments in [Section 10.1.3](#), [Section 10.6.1](#) and [Section 10.8.1](#))
- *"This failure to consider statistical significance results in an interpretation that cancer rates differ between proxy measures of exposure (< 2 miles from SSFL versus 2-5 miles from SSFL) or diagnostic periods (1988-1995 versus 1996-2002) when in reality they do not, provided one considers the slight differences between effect estimates and the extreme width of the confidence intervals bracketing them."* (Confirms author's comments in [Section 10.6.1](#))
- *"Also, 23 of the 204 calculated rate ratios (11%) are statistically significantly reduced. Obviously, it is no more appropriate to conclude that these numbers reflect that living in close proximity to SSFL is protective against cancer, anymore, than it is to conclude that the very modest elevations observed reflect an elevated risk related to SSFL."* (Confirms author's comments in [Section 10.6.1](#))
- *"Data fail to support an excess cancer risk."*

10.6.3 Blot Critique of the Morgenstern Study (2007)

Boeing commissioned Dr. William Blot to review the Morgenstern study. Dr. Blot is an epidemiologist at the International Epidemiology Institute (IEI) and Professor of Medicine at the Vanderbilt University Medical Center.

- Blot, [Critique of the March 2007 Final report "Cancer Incidence in the Community Surrounding the Rocketdyne Facility in Southern California](#). Highlighted version. March 20, 2007. Author Source.

Some of Dr. Blot's comments include,

- *"There were slightly higher rates for "chemosensitive cancers" among those living within 2 miles, but the increases were not significant, and the rates for "radiosensitive cancers" were essentially the same in all three distance groups. Somewhat higher rates of several individual cancers, including thyroid cancer, were observed among those living within 2 miles, but none of the increases were significant. Similarly, somewhat lower rates of several individual cancers were observed among those living within 2 miles, but none of*



the decreases were significant. In tables showing the rates by race/ethnic group, it appears that any higher rates may have been accounted for by higher rates among Hispanic residents, with rates among non-Hispanic whites being lower among those who lived within 2 miles than among those who lived 5 or more miles from SSFL.”

- *“The results of the Morgenstern et al analysis fall more in the latter (little or no geographic differences) than the former (significant geographic variation) category. Thus the findings indicate no overall differences in the standardized cancer rates according to residence near vs farther from SSFL, consistent with the notion that there has been no generalized hazard over the 15-year span 1988-2002 related to the SSFL facility.”*
- *“Out of the 36 rate ratios, 19 were slightly above 1.0 and 17 were slightly below or equal to 1.0. Only 2 have confidence limits that exclude the null value of 1.0 (and are thus statistically significant), about the number of significant findings to be expected by chance alone if one were conducting a similar number of independent statistical comparisons.”*

10.7 Thomas Mack (2011-2014)

In 2004, Dr. Thomas Mack of the USC Keck School of Medicine published a book entitled, “Cancers in the Urban Environment - Patterns of Malignant Disease in Los Angeles County and its Neighborhoods.” Dr. Mack, professor of preventative medicine and pathology, established himself as a pre-eminent cancer epidemiologist.

In July 2011, Dr. Mack investigated cancers in West Hills, CA, and gave an invited lecture to the West Hills Neighborhood Council.

- Mack, [Cancer by Neighborhood](#), July 2011. Author Source.

Dr. Mack’s conclusions were,

- *“The most extreme finding is the apparent increase in bladder cancer risk in the most northerly, and to a lesser extent in the next most northerly, tract in West Hills. The former increase would probably be as great by chance in 8 or 9 tracts in Los Angeles County.”*
- *“No increase was noted among female residents of the West Hills tracts, and bladder cancer generally occurs more frequently among smokers, among upper middle-class men, and among those employed in certain occupations. The observed increase is therefore not surprising.”*

Dr. Mack was asked by DTSC to conduct a cancer registry study in the communities surrounding SSFL. On April 9, 2014, Dr. Mack presented his study in a public meeting hosted by DTSC.

- Mack, [Cancer Occurrence in Offsite Neighborhoods Near the Santa Susana Field Laboratory](#), April 9, 2014, DTSC Source.



Dr Mack reviewed previous cancer registry studies and identified *“reasons for scientific skepticism,”*

- *“Lack of any clear risk found by previous searches”*
- *“Previous searches were inconclusive”*
- *“Ambiguous and controversial exposure estimates”*
- *“The presence of a carcinogen, especially when technology permits detection of very low levels, does not necessarily constitute a major hazard”*
- *“High dose levels are needed to produce a measurable cancer excess”*

Specific comments on the Morgenstern study were,

- *“Multiple comparisons without adjustment”*
- *“Weak associations”*
- *“Aggregation obfuscates location”*
- *“Distance is not dose”*
- *“Confounding by social class”*

Dr. Mack’s conclusions following his study were,

- *“It is not possible to completely rule out any offsite carcinogenic effects from SSFL”*
- *“No evidence of measurable offsite cancer causation occurring as a result of emissions from the SSFL was found.”*
- *“Further, no evidence of any cancer causation by any environmental factor was found.”*

10.8 Flawed Statistics

Reference has been made several times in discussing the DHS and Morgenstern studies about using the theoretical Poisson approximation for the standard deviation of county cancer rates. Dr. Alan Warren’s comments on the Morgenstern study also criticized the *“extremely narrow theoretical confidence limits calculated for the referent group.”* A detailed explanation of this flawed approximation is illustrated in the following documents. The first is notification to DHS management in the 1990s of its use of the flawed approximation. The second is a presentation made to Boeing management in 2006. The third uses cancer registry data from Humboldt County in Northern California to illustrate how this flawed approximation can cause erroneous conclusions.

- Rutherford/Boeing, [Summary of State Cancer Studies](#), October 1996, March 1997, April 1999, Author Source.
- Rutherford/Boeing, [Critique of DHS’s and Morgenstern’s Use of the Poisson Approximation for Variability in Baseline Cancer Rates](#), Original date February 2, 2006, Revision October 22, 2022. Author Source.



- Rutherford, [Effect of Using True Variability for Baseline Cancer Rates](#), November 21, 2016. Author Source.

10.9 DTSC Summary of Community and Worker Health Studies

DTSC's summaries of community and worker health studies are at ...

- DTSC, [Summary of Cancer Study and Exposure Assessment Activities and Document Release Dates related to the Santa Susana Field lab \(Rocketdyne\) Site](#). Undated. DTSC Source.
- DTSC, [Summary of Cancer Study and Exposure Assessment Activities related to the Santa Susana Field Laboratory \(Rocketdyne\) Site](#). DTSC Source.

It is noticeable that DTSC, unlike Boeing and the author, does not provide links to the original studies EXCEPT the Hirsch sponsored studies of the 2006 Advisory Panel. Why did you do this, DTSC?

10.10 Dr. Weitzberg's Summary of Community and Worker Health Studies (2014)

Dr. Abe Weitzberg is a retired nuclear engineer, a long-ago employee of Atomics International and recent member of the SSFL Community Advisory Group. (CAG).

- Weitzberg, [Review of Studies of Health Effects Possibly Related to the Operation of the Santa Susana Field Laboratory \(SSFL\)](#), June 18, 2014. Author Source

10.11 Boeing's Message to Visitors to SSFL (2014)

The following is a handout summarizing conclusions of the various community cancer studies, given to bus tour and nature walk visitors to SSFL since 2014.

- Boeing, [Community Cancer Studies](#), Revised June 24, 2019, Boeing Source.

10.12 PowerPoint Review of ATSDR Sponsored Studies (2016)

In 2016, the author prepared a PowerPoint presentation on the ATSDR sponsored studies including the Morgenstern Community Cancer Study and Cohen Community Exposure Study.

- Rutherford, [ATSDR Sponsored Community Health Studies](#), July 20, 2016. Author Source.



11.0 COMMUNITY EXPOSURE STUDIES

In contrast to the numerous and extensive media sampling studies conducted in the surrounding neighborhoods of SSFL ([Section 8.0](#)), there have been three studies that reviewed existing documents and data and hypothesized potential exposures to the community. The first was conducted by the federal Agency for Toxic Substances Disease Registry (ATSDR) in 1999. The second was conducted by the Advisory Panel (headed by Dan Hirsch) in 2006. The third was conducted by Professor Yorum Cohen of UCLA in 2006.

It should be stressed that no additional offsite sampling was conducted during any of these studies. These three studies are discussed below.

11.1 ATSDR (1999)

In 1999, at the urging of Senator Diane Feinstein and Representative Elton Gallegly, the Agency for Toxic Substances Disease Registry (ATSDR) conducted a preliminary site evaluation (review of SSFL operations and records).

- ATSDR, [Draft Preliminary Site Evaluation, Santa Susana Field Laboratory \(SSFL\), Ventura County, California](#) , CERCLIS No. CAD074103771, December 3, 1999. DTSC Source.

ATSDR concluded ...

- *"In this preliminary evaluation of available data and information, ATSDR has not identified an apparent public health hazard to the surrounding communities because people have not been, and are currently not being, exposed to chemicals and radionuclides from the site at levels that are likely to result in adverse health effects."*

Nevertheless, ATSDR recommended further studies to ...

1. assess off-site exposures and potential public health implications,
2. update and reanalyze California cancer registry data,
3. perform community outreach, interaction, and health education, and
4. conduct additional radiological characterization of Area IV.

Subsequently, ATSDR contracted with the Eastern Research Group (ERG), who in turn issued a sole source contract to the University of California at Los Angeles (UCLA) to perform the first three of these tasks. The statement of work from ERG/ATSDR for these three tasks is ...

- ERG/ATSDR, [Santa Susana Field Laboratory Public Health Activities](#), Undated, Author Source.



Ultimately in 2006-2007, two studies were published addressing recommendations 1 and 2. These became known as the Cohen Exposure Assessment Study (UCLA) (Section 11.3) and the Morgenstern Cancer Incidence Study (U. of Michigan) (Section 10.6). The author is unaware of any significant activities conducted for the third task, other than facilitating two public meetings, giving a status update for the first two tasks.

The fourth recommendation was implemented by the EPA in 2008-2012 (Section 5.3)

11.2 SSFL Advisory Panel (2006)

The SSFL Advisory Panel⁸⁰ was originally formed to oversee the 1997-1999 UCLA worker health studies (Section 9.1 and Section 9.2). On October 5, 2006, the panel members and their consultants released the following reports, focusing on a hypothetical exposure resulting from the SRE Accident (Section 4.0) and groundwater migration.

Ventura County Star 2006

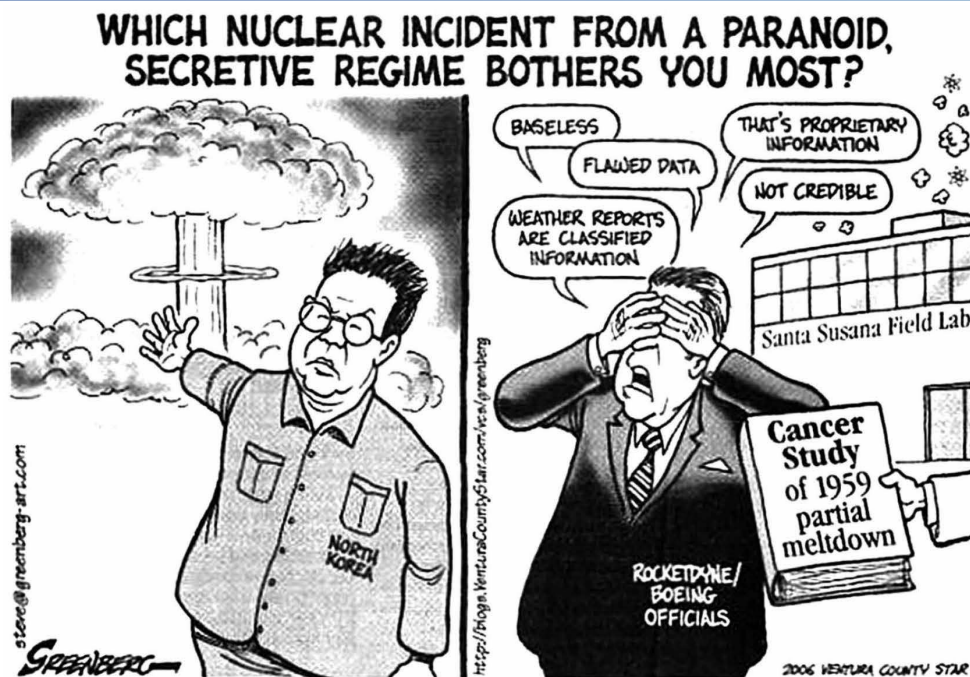


Figure 24. Media Humor about the SRE Accident

⁸⁰ SSFL Advisory Panel, "The Santa Susana Field Laboratory Advisory Panel." <https://www.ssflpanel.org/>. Accessed August 22, 2022. The SSFL Advisory Panel is not associated with, and is independent of, the Santa Susana Field Laboratory



The SSFL Advisory Panel issued a total of seven reports but the first three that focused on the SRE Accident received the most attention.

- Advisory Panel, [Report of the SSFL Advisory Panel](#), October 2006. Advisory Panel Source.
- Lochbaum, David A., [An Assessment of Potential Pathways for Release of Gaseous Radioactivity Following Fuel Damage During Run 14 at the Sodium Reactor Experiment](#), October 5, 2006. Advisory Panel Source.
- Beyea, Jan, [Feasibility of Developing Exposure Estimates for use in Epidemiological Studies of Radioactive Emissions from the Santa Susana Field Laboratory](#), October 5, 2006. Advisory Panel Source.
- Wilshire, William G., [Geologic Features and Their Potential Effects on Contaminant Migration, Santa Susana Field Laboratory](#), October 5, 2006. Advisory Panel Source.
- Bianchi, William C., [An Analysis of the Clay Cap to Control Groundwater Recharge Below the Former Sodium Burn Pit](#), October 5, 2006. Advisory Panel Source.
- Tabidian, M. Ali, [Land-Use Conversion and its Potential Impact on Stream/Aquifer Hydraulics and Perchlorate Distribution in Simi Valley, California](#), October 2006. Advisory Panel Source.
- Kowalski, Dawn; Mason, Marie; Huff, Holly & Johnson, Barbara, [Loss of Innocence](#). Advisory Panel Source.

11.2.1 Boeing Response to Advisory Panel Report (2006)

The following day, on October 6, Boeing responded to numerous media inquiries. The following is typical of Boeing's immediate response.

- Rutherford/Boeing, [Statement Provided by The Boeing Company to Los Angeles Radio Station KPCC National Public Radio](#), October 6, 2006. Author Source.

Technical responses to the Advisory Panel Reports were communicated to legislators and regulators less than a month later:

- Boeing, [Comments of The Boeing Company on the Reports of the SSFL Advisory Panel](#), November 3, 2006. DOE Source.
 - As often happens, several URL addresses were renamed or were moved after publication of Boeing's comments. These URLs are corrected in this version of [Boeing's Comments](#). Author Source.
- Frazier, John R., [Review of the Beyea and Lochbaum Reports](#), November 4, 2006. DOE Source.
- Krsul, John R., [Review and Evaluation Report of David A. Lochbaum](#), November 4, 2006. DOE Source.
- Groundwater Advisory Panel, [Review of the Bianchi, Wilshire and Tabidian Reports](#), November 5, 2006. DOE Source.



Boeing's cover letter summarized its enclosed detailed comments, in particular Lochbaum's and Beyea's inflated and unrealistic estimates of releases from the SRE accident and hypothetical offsite impacts.

- *"Both the Lochbaum and Beyea reports provide estimates of fission product release fractions that are nothing more than guesses. Mr. Lochbaum reasoned that if 30% of the fuel elements were damaged then an upper bound for fission product release was 30%. He acknowledged that a lower bound would be closer to 0%, so the best estimate or average would be $(30\% + 0\%)/2 = 15\%$. He did not estimate release in terms of curies. Mr. Lochbaum does not account for the fact that evidence from other sodium cooled reactors has shown that iodine-131 and cesium-137 released from the fuel would be retained in the sodium coolant. Dr. Beyea's estimate was little better, instead relying on the 1957 Windscale release. Dr. Beyea omits the facts that Windscale was a once-through, air-cooled system, and that when the core was burning, there was an open release pathway directly to the environment. Dr. Beyea omits the fact that the SRE fuel was continually immersed in a closed-loop pool of sodium coolant which trapped iodine and cesium, as discussed above."*
- *"Environmental sampling studies performed over the last 14 years have unequivocally demonstrated that cesium-137 is not in the soils of communities surrounding SSFL at levels that differ significantly from local background. These studies demonstrate that cesium-137 releases of the size postulated by Dr. Beyea could not have occurred. Many of these studies have been conducted by organizations independent of Boeing. Those studies conducted by Boeing have been under the oversight of numerous regulatory agencies, including DHS, DTSC, and the EPA."*

The author is unaware of any responses to Boeing's comments by the Advisory Panel or from any of the many federal, state, or local legislators, or any agency management who were included on distribution. This is typical of the silence when public officials are provided with facts to counter misinformation and disinformation.

11.2.2 Health Physics Society Response (2006)

The Los Angeles Times and Newsweek carried stories of the Advisory Panel Reports, prompting the Health Physics Society to respond directly to the Times and Newsweek on October 19, 2006..

- [Letter from the Health Physics Society to the Los Angeles Times](#), October 19, 2006. Author Source.
- [Letter from the Health Physics Society to Newsweek](#), October 19, 2006. Author Source.



11.2.3 Former Reviews of the SRE Accident (2005)

In 2005, one year prior to the 2006 Advisory Panel reports, two Boeing commissioned studies were completed that confirmed earlier findings that only small quantities of noble gases were released following the accident and that no iodine-131 or cesium-137 was released.

- Christian, Jerry D., [Chemical Behavior of Iodine-131 During the SRE Fuel Element Damage in July 1959](#), May 26, 2005. DOE Source.
- Daniel, John A. Jr., [Investigation of Releases from Santa Susana Sodium Reactor Experiment in 1959](#), May 27, 2005. DOE Source.

11.2.4 Union of Concerned Scientists Position on the SRE Accident

The Union of Concerned Scientists (UCS)⁸¹ is an effective and vocal non-profit organization founded in 1969 by scientists and students at the Massachusetts Institute of Technology (MIT). Its original mission was to turn away research from military technology towards environmental and social problems. UCS was anti-war, anti-nuclear weapons. All admirable goals. Since its founding, UCS has also regarded itself as a nuclear safety watchdog, standing guard to ensure the NRC does its job. UCS believes *“that a well-regulated nuclear industry is in everyone’s best interest - especially the industry itself.”*

David Lochbaum, a co-opted author of one of the Advisory Panel reports, was employed by the UCS from 1996 to 2018. The UCS website has a brief summary of the SRE accident, dated October 1, 2013.⁸² It is quoted here in its entirety.

- *“A partial meltdown occurred at the Sodium Reactor Experiment (SRE) due to cooling flow blockage that caused the reactor core to overheat. The SRE experienced extensive fuel damage during a power run. Thirteen of forty-three fuel elements overheated when the cooling flow provided by the liquid sodium was blocked by tetralin, an oil-like fluid which had leaked into the primary sodium loop during prior power runs. This overheating caused the reactor core to fail. Fission products were released from the damaged fuel into the primary sodium loop. Some of the fission products leaked from the primary sodium loop into the high bay area, a region inside the building housing the reactor. Other fission products flowed with the helium cover gas over the liquid sodium in the reactor pool to gaseous storage tanks. Fission products from the high bay area and from the gaseous storage tanks were processed through the filters of a ventilation system and discharged to the atmosphere.”*

⁸¹ UCS Website. Available at <https://www.ucsusa.org/>. Accessed September 16, 2022.

⁸² UCS, “A Brief History of Nuclear Accidents Worldwide”, October 1, 2013. Available at <https://www.ucsusa.org/resources/brief-history-nuclear-accidents-worldwide>. Accessed September 16, 2022.



Just the plain facts, unadulterated with wild exaggeration and hyperbole, no claim to be the “worst nuclear disaster in US history,” no claims of thousands of curies released, no claims of thousands of cancers. Indeed the Three Mile Island-2, Enrico Fermi Unit 1 and the SL-1 accidents in the US all have higher billing in this UCS summary.

11.3 UCLA Cohen Exposure Assessment Study (2006)

One of the recommendations of the 1999 ATSDR preliminary site evaluation ([Section 11.1](#)) was ...

- *“A more in-depth evaluation of exposure pathways that addresses past, current, and future exposure to chemicals and radionuclides from the SSFL should be conducted to improve the assessment of potential offsite exposures and public health implications associated with this site.”*

Subsequently, ATSDR contracted with the Eastern Research Group (ERG), who in turn issued a sole source contract to the University of California at Los Angeles (UCLA) to perform this task.

Ultimately in 2006, a study was published addressing recommendation 1. This became known as the Cohen Community Exposure Assessment Study (UCLA).

In February 2006, preliminary results of the exposure assessment were presented to the public during a SSFL Workgroup meeting.

- Cohen, Yoram & Katner, Adrienne, [Potential for Offsite Exposures Associated with Contaminants from Santa Susana Field Laboratory](#), Presentation to the public. February 2, 2006. Author Source.

In August 2006, Dr. Cohen published the final draft exposure report and requested comments to be submitted by September 30, 2006. Curiously, the report was actually dated February 2, 2006, the date of the previous public meeting. It was not obvious whether the “draft” and the February 2, 2006, date were errors or what?

- Cohen et. al., [The Potential for Off-Site Exposures Associated with Contaminants from Santa Susana Field Laboratory](#), Final Draft Report (Complete). February 2, 2006. DTSC Source.
 - Chapters 1 & 2. [Introduction and Identification of Chemicals of Concern](#)
 - Chapter 3. [Air Pathway Analysis](#)
 - Chapter 4. [Groundwater and Surface Water Pathways](#)
 - Chapter 5. [Soil and Sediment: Monitoring and Containment Migration](#)
 - Chapter 6. [Exposure Analysis](#)
 - Chapter 7. [TCE Contamination](#)



- Chapter 8. [Implications of Data Quality, Monitoring, and Continuing Cleanup for Public Health Assessment and Future Land Use](#)
- Chapter 9. [Conclusions and Recommendations](#)
- Chapter 10. [References](#)
- Appendix A. [List of Acronyms](#)
- Appendix B. [Glossary](#)
- Appendix C. [List of Chemicals of Potential Concern](#)
- Appendix D. [Site Facilities and Waste Management Facilities](#)
- Appendix E. [Partial List of Violations Cited, Hazards Observed by Site Inspectors, and Accidents](#)
- Appendix F. [Contaminants of Concern and Sources of Toxicological Information and Health Based Standards](#)
- Appendix G. [Interview Documentation](#)
- Appendix H. [Monitoring Data Compendium](#)
- Appendix I. [Air Dispersion Modeling](#)
- Appendix J. [Requests for Well-Related Information](#)
- Appendix K. [Groundwater Well and Surface Water Station Background](#)
- Appendix L. [Fate and Transport Information Sources for Contaminants of Concern](#)
- Appendix M. [SCRAM Ranking: Chemical, Uncertainty, Composite Scores, Ranking, and Weightings](#)
- Appendix N. [Standards Used for Chemical Ranking and Exposure Analysis](#)
- Appendix O. [Compilation of the Data and Reports Reviewed](#)
- Appendix P. [Regulatory Oversight](#)
- Appendix Q. [Comments on EPA's Hazard Risk Scoring \(HRS\) for SSFL](#)
- Appendix R. [Dose and Dose Ratio Estimations](#)
- Appendix S. [Air Emissions](#)
- Appendix T. [Estimation of Receptor Air Concentrations and Doses](#)
- Appendix U. [SSFL Sandstone Sorption and Diffusion Experiments](#)

11.3.1 Boeing Response to the Cohen Exposure Report (2006)

Boeing submitted comments on September 29, 2006. The author was lead reviewer and editor. Boeing stated that there are many factual, methodological and data inaccuracies in these reports including speculative conclusions not supported by the data.

- Boeing, [Comments of The Boeing Company on the UCLA Exposure Study](#), September 29, 2006. DOE Source.
 - As often happens, several URL addresses were renamed or were moved after publication of Boeing's comments. These URLs are corrected in this version of [Boeing's Comments](#). Author Source.
- Groundwater Advisory Panel, [Comments on the UCLA Exposure Study](#). September 29, 2006. DOE Source.



Boeing's detailed comments were preceded by a cover letter that summarized the major criticisms of the Cohen report. These were,

"Our detailed comments on specific portions of the report are provided in an attachment to this letter. However, Boeing has a number of general concerns and comments regarding the overall approach taken in preparing the report, which are set forth below. Taken as a whole, these concerns seriously question the validity of the report's conclusions. The basis for this position is provided in the detailed comments in the attachment."

"First, Boeing has numerous concerns related to the methodology and use of data in the report. The report includes many worst-case assumptions and conservative toxicity factors, which result in overly inflated dose ratios. Multiple conservative assumptions, when compounded, result not in a worst-case scenario but one that is highly improbable, if not impossible, and which does not represent potential risk for any single individual or group of individuals. Such overly inflated dose ratios may cause the reader to incorrectly conclude that the SSFL poses an unacceptably high risk, when in reality the actual risk is much lower and in many cases may be at or near zero. Thus, the result is a study that will be prone to misinterpretation and constitute a disservice to the reader."

"Second, the report fails to acknowledge numerous conclusions that state and federal agencies have made concerning SSFL and the surrounding communities."

"The Agency for Toxic Substances and Disease Registry (ATSDR), which funded this study, reached the following conclusion, after completing their own study:

"ATSDR has not identified an apparent public health hazard to the surrounding communities because people have not been and are currently not being exposed to chemicals and radionuclides from the site at levels that are likely to result in adverse health effects." [ATSDR]

The UCLA report utilized essentially the same environmental data base used by the ATSDR study, yet it reached very different conclusions without explaining the basis for such a departure."

"Other regulatory agencies have made the following statements to address concerns regarding the health of the community surrounding SSFL:

"These analyses suggest that people living near the SSFL are not at increased risk for developing cancers associated with radiation exposure." [DHS]

"EPA is not aware of any current contamination from the SSFL that poses an unacceptable risk to the community." [EPA]



"Three studies of cancer incidence in the vicinity of SSFL were reviewed...the combined evidence from all three does not indicate an increased rate of cancer in the regions examined. The results do not support the presence of any major environmental hazard." [DTSC Expert Panel]

"Third, the report bases its analysis on the maximum values of a small number of environmental positive detects for soil and water and ignores the totality of the environmental database that is comprised of mostly non-detects, thereby providing inaccurate and misleading portrayals of potential exposure issues. For example, Figure 4-3 of the report presents a map of groundwater contaminants detected above health-based standards. The map shows the concentration of carbon tetrachloride at nine times the California Maximum Concentration Level. However, this representation is misleading because it fails to indicate that of the 895 offsite analyses conducted for this chemical, there were only 2 off-site detections (see Table 7 of ATSDR's 1999 evaluation). Identifying two detections, while failing to mention 893 non-detections, is not a fair and accurate portrayal of the groundwater data. The use of maximum detects to calculate dose ratios is a poor surrogate for estimating community exposures using the entire body of relevant data."

"Fourth, the report also ignores crucial facts concerning the question of past exposures. For example, the study suggests that historical exposure to TCE emissions from rocket engine testing/degreasing is a potential concern for many lifelong residents living in eleven "receptor locales." Modeling results show that TCE concentrations rapidly decline with distance from the site (to approximately 2 µg/m³ at just 1 mile). Approximately 89% of TCE emissions from rocket engine testing/degreasing occurred before 1967. Before 1967, less than twenty residents resided in the census tract encompassing most of the 1- mile area surrounding SSFL. Yet, the study lists elevated dose ratios at eleven "receptor locales," some of which are located 5 to 10 miles from SSFL. The report also incorrectly uses the large exhaust rates for large LOX-kerosene engines for the much smaller hydrazine engines. This has resulted in an over-estimate of hydrazine emissions by at least 100-fold."

"Fifth, the report ignores the fact that background levels of some chemicals and radionuclides are found in all soils. The report fails to subtract background from off-site measurements prior to comparing to health-based standards. Consequently, off-site measurements of background chemicals and radionuclides are incorrectly identified as contamination from SSFL."

"Sixth, the report does not adequately establish exposure pathways. Transport of specific contaminants should be traced from an identified SSFL source, through an air or water transport medium to a receptor (local resident). Specific effects on the food chain, if any, should be identified. Exposure modes should be established (e.g. inhalation, ingestion, dermal contact, etc.). Temporal changes in populated areas should be assessed. Finally, the likelihood of occurrence of the postulated exposure pathways needs to be quantified. Only, then can a realistic risk assessment be performed."



“Seventh, the report repeatedly claims that assessing health risk impacts was not possible and beyond the scope of the study. Yet the report presents dose ratios based on overly conservative estimates of exposures, and then draws conclusions about public health significance.”

“Extensive environmental investigations have been ongoing for many years with regulatory agency review and approval. Until this report, the data have shown that neighboring communities have not been adversely impacted by SSFL operations. We have an extensive network of groundwater wells both on and offsite and have been monitoring these wells for 20 years. Based on our testing of known domestic wells in the vicinity of SSFL, we believe offsite receptors are not being exposed to contaminants in drinking water resulting from SSFL operations. Groundwater quality monitoring data show a few sporadic detections, all of which are either below health-based primary drinking water standards, are attributed to well owner activity, are naturally occurring, or are inconclusive as to source of contaminant. We have years of extensive environmental data, and we stand behind it.”

This author is unaware of any responses to Boeing’s comments from the Cohen team or from any federal, state, or local legislators, or any agency management who were included on distribution. This is typical when officials are provided with facts to counter their and others’ misinformation.

The author is unaware of any comments on the Cohen report by either its sponsor, ATSDR, or its funding organization, Eastern Research Group.

It was uncertain whether the “final draft” report would be updated to a “final final” report responding to Boeing’s comments. However, this never happened. It is noteworthy that as of August 2022, the UCLA Cohen report appears to have vanished from the UCLA website, perhaps because subsequent internal review recognized its significant shortcomings. The report is not even listed in Dr. Cohen’s CV.⁸³

11.3.2 Warren Response to the Cohen Exposure Report (2006)

Boeing commissioned Dr. Alan Warren to review the Cohen study. Dr. Warren is Program Director of Environmental Health Science at the University of South Carolina, Beaufort. Dr. Warren also reviewed the Morgenstern Community Cancer Study in 2007.

- Warren, Alan, [Comments on the UCLA Exposure Study](#). September 29, 2006. DOE Source. [Highlighted Comments on the UCLA Exposure Study](#). September 29, 2006. Author Source.

⁸³ UCLA, “Yoram Cohen.” Available at <https://www.ioes.ucla.edu/person/yoram-cohen/>. Accessed August 22, 2022.



Dr. Warren took 4 pages to effectively trash Dr. Cohen's 271-page exposure study. His criticisms included,

- *"Unfortunately, no effort is made in the present study to reconcile it with that published by ATSDR just 6 years earlier."*
- *"In this regard, it is noteworthy that the overwhelming majority of monitoring data compiled and evaluated in the present study was collected prior to 1999 and was thus available to ATSDR when formulating its conclusions. Seemingly, the authors of the present study would be obliged to discuss their study in the context of that of ATSDR, especially considering that it was conducted in response to recommendations made in ATSDR's preliminary evaluation and is an ATSDR-funded initiative."*
- *"In the case of the present study, however, the absence of data does not justify giving credence to an array of potential exposure scenarios regardless of their probability of occurrence, or in the event they did occur, how insignificant the added health risks might be. In fact, the study does so despite what amounts to a lack of empirical evidence for any fully completed exposure pathway for any of the numerous "chemicals of concern.""*
- *"Nonetheless, dose ratios (DRs) were calculated in what can only be described as a screening-level risk assessment apt to mislead those not technically astute enough to differentiate hypothetical from real risk or recognize the study represents the application of the precautionary principle run amuck."*
- *"Such dose ratios create the false impression that a particular exposure scenario may pose an unacceptably high risk, when in reality, the actual risk is much lower and in many cases at or near zero."*
- *"Multiple conservative assumptions, when compounded, result not in a worst-case scenario but one that is highly improbable, if not impossible, and pertains to no single individual or group of individuals."*
- *"We are thus left with a study prone to misinterpretation that will be cited in support of the argument that chemicals and/or radionuclides emanating from SSFL are a plausible explanation for every past, present and future illness and untimely death of unknown etiology."*
- *"For example, the study suggests that historical exposure to TCE emissions from rocket engine testing/degreasing is a potential concern for many lifelong residents living in eleven "receptor locales." However, 89% of TCE emissions from rocket engine testing/degreasing occurred pre-1967 at a time when less than twenty residents resided in the census tract encompassing most of the 1-mile area surrounding SSFL."*
- *"Another example of the study's bent to portraying exposure issues in a bad light is found in Figure 4-3, which presents a map of groundwater contaminants detected above health-based standards. The map reports that the concentration of carbon tetrachloride was nine times the California MCL, but fails to indicate that of the 895 offsite analyses*



conducted for the chemical, there were only 2 offsite detections (see Table 7 of ATSDR's 1999 evaluation)."

- "For example, a slide was presented at a February 2006 SSFL Workgroup Meeting showing annual average SSFL emissions (1955-2000) relative to those of Los Angeles and Ventura counties in 1990-1993. The slide indicated that with the exception of hydrazine, SSFL was responsible for a miniscule fraction of the hazardous air pollutants emitted (< 5% in the case of TCE)."
- "Such information would suggest that SSFL emissions are at best, a minimal contributor to one's overall risk, thereby allowing the study's results to be placed into proper perspective. This is important given the pending release of a report on cancer incidence surrounding SSFL. Given its worst-case approach, the present study is incapable of providing realistic exposure data to explain differences in cancer incidence rates. The absence of such data explains the epidemiological study's reliance on residential distance from SSFL as a surrogate measure of exposure. The use of such a surrogate will result in almost certain exposure misclassification that can lead to a substantial overestimation or underestimation of the association of the exposure with the cancers under study. As such, it is alone sufficient to cast doubt upon the study as a reliable indicator as to whether SSFL has posed a cancer risk to nearby residents."
- "If the February 2006 presentation on cancer incidence near SSFL is indicative of the soon-to-be-released epidemiological study, findings suggest historical exposures from SSFL have not posed a considerable cancer risk. Based on the February presentation, very few of the 36 risk ratios (RRs) graphically presented appeared significantly elevated. Furthermore, only three of the 36 reported RRs were in excess of two and all three occurred among Hispanics, very few of whom lived near SSFL when emissions were at their highest."
- "Thus, it appears as though the results of the soon-to-be-released epidemiological study will be largely consistent with the conclusions of ATSDR's preliminary evaluation and fail to support the level of concern for past exposures conveyed by the present study."



12.0 OFFSITE DISPOSAL OF DECOMMISSIONED MATERIAL

In the late 1990s and early 2000s, offsite disposal of soil and building debris from Area IV became a controversial issue. The allegation was that any material shipped from Area IV of SSFL, irrespective of sampling and instrument measurements showing that clearance/release limits had been met, was nevertheless exposing the public to harmful levels of radiation and radioactivity.

Although Senator Barbara Boxer proved to be a perennial opposition to SSFL, as will be seen from the following sections, it was Senator Diane Feinstein who sent the first shot across the bow from the Senate. In May 1999, she sent a series of letters to the Clinton Administration complaining about decommissioning cleanup standards at SSFL.⁸⁴ Of course, it was not Senator Feinstein complaining ... it was Dan Hirsch. He is adept at writing letters for politicians' signatures. I have been unable to locate Senator Feinstein's original letters, however the following was my response.

- Rutherford/Boeing, [Radiation Cleanup Standards - A Position Paper](#), June 10, 1999. Author Source.

Subsequently, following promulgation of SB 990, a position paper was prepared demonstrating that it was technically infeasible to distinguish radionuclide contamination in soil at a 1-in-a-million risk level above background for agricultural land use.

- Rutherford/Boeing, [Technical Feasibility of Detecting Radionuclide Contamination in Soil at a 10⁻⁶ Risk Level for Agricultural Land Use](#), March 6, 2007. DOE Source.

The companion paper to this paper, "Nuclear Decommissioning at SSFL: 20+ Years of Politics vs, Science",⁸⁵ describes in detail the various anti-SSFL legislation, litigation and regulatory actions that occurred since 2000 to the present date. The sections below describe some of the projects that were impacted, and some of the outreach that occurred during the period 1999-2022.

12.1 FSDF Soil Disposal (2000)

Remediation of chemicals and radionuclides at the Area IV Burn Pit (subsequently renamed the Former Sodium Disposal Facility (FSDF)) was initiated in 1990. Radiological decommissioning is described below.

⁸⁴ Los Angeles Times, "Senator Seeks Tougher Cleanup Standards at Rocketdyne Lab", May 8, 1999. Available at <https://www.latimes.com/archives/la-xpm-1999-may-08-me-35098-story.html>. Accessed November 8, 2022.

⁸⁵ Rutherford, "Nuclear Decommissioning at the Santa Susana Field Laboratory: 20+ Years of Politics vs. Science." Available at https://philrutherford.com/SSFL/Nuclear_Decommissioning_at_SSFL.pdf. Accessed September 13, 2022,



- Boeing, [Final Report for Decontamination & Decommissioning of Former Sodium Disposal Facility \(FSDF\) - B/4886](#), November 17, 1999. DOE Source.
- [Decommissioning Documents for Building 4886 \(Former Sodium Disposal Facility\)](#), January 21, 2022. Author Source.
- Rutherford/Boeing, [A Radiological History of the Sodium Disposal Facility](#), April 25, 2000. DOE Source.
- Boeing, [Speaking of ... The Former Sodium Disposal Facility](#), August 1996. DOE Source.

In May 1998, following surveys and soil sampling by Rockwell and verification soil sampling by CDHS/RHB, the agency released the facility for (radiologically) unrestricted use, and removed the FSDF from Rocketdyne's Radioactive Materials License 0015-19.

- DHS-RHB, [Letter from Gerard Wong \(CDHS/RHB to Phil Rutherford \(Boeing\), Untitled](#), May 15, 1998. DOE Source.

Following this radiological milestone, further remediation was conducted to remove remaining chemical contamination. As a result an additional 13,500 metric tons of soil was removed and stored in 800 roll-off containers. Boeing made arrangement to ship this soil to the Kettleman Hills Class I Hazardous Waste Disposal Facility.

Dan Hirsch, State Senator Sheila Kuehl, and Senator Barbara Boxer questioned whether soil from the FSDF should be sent to Kettleman Hills, falsely claiming that the soil was radioactive waste.

At DTSC's continual questioning, the CDHS/RHB sent DTSC no less than three further letters explaining the concept of "release for unrestricted use" and stating that this action relieved Rocketdyne of any regulatory requirement to implement any further radiological controls relative to waste from the FSDF. This includes no requirement to monitor, sample or screen any soil taken from the FSDF during subsequent excavations.

- DHS-RHB, [Letter from Roger Lupo \(DHS/RHB\) to Gerard Abrams \(DTSC\), Untitled](#), February 18, 1999 or 2000. Author Source.
- DHS-RHB, [Letter from Edgar Bailey \(Chief, DHS/RHB\) to Wade Cromwell \(DTSC\), Untitled](#), February 23, 1999 or 2000. Author Source.
- DHS-RHB, Letter from Edgar Bailey (Chief, DHS/RHB) to James M. Pappas (DTSC), [Former Sodium Disposal Facility Soils](#), May 2, 2000. Author Source.

Hirsch, Kuehl, and Boxer sent DTSC and CDHS/RHB a set of questions which it required answering before it would "allow" the FSDF soil to be sent to Kettleman Hills. The author has been unable to locate the original letter transmitting these questions. While DTSC and CDHS/RHB spent considerable time providing answers to these questions, the author compiled the following material.



- Rutherford/Boeing, [Sodium Disposal Facility Soil for Disposal to Kettleman Hills](#), May 14, 2000. Author Source.
 - Pertinent regulatory questions to be asked relative to the legality of disposal of FSDF soil at Kettleman Hills.
- Rutherford/Boeing, [Compliance with Radiological Requirements pertaining to Waste Disposal in the State of California](#), June 29, 2000. Author Source.
 - Material that meets approved radiological cleanup standards, and which has been "released for unrestricted use", may be sent to sanitary or hazardous landfills, recyclers, or otherwise transferred to any other entity.
- Rutherford/Boeing, [Response to Hirsch/Kuehl/Boxer Questions](#), June 29, 2000. Author Source.
 - These responses were provided to its customer, the Department of Energy.

In December 2000, the DTSC and DHS/RHB finally provided answers to questions posed by Hirsch/Kuehl/Boxer. The letter transmitting these answers stated unequivocally that there was no radiological hazard from the FSDF soil and stated that the soil could be legally and safely disposed of at a permitted Class I hazardous waste facility.

- [Letter from Kevin Reilly \(DHS\) and Bob Borzelleri \(DTSC\) to Senator Barbara Boxer and Senator Sheila Kuehl](#), December 2000. DOE Source.
 - [Attachments](#) to DHS/DTSC Letter. DOE Source.

Kettleman hills had become so spooked by all this political attention that it refused to accept the waste unless Barbara Boxer gave them her personal approval to accept the waste ... which of course she would never do. Subsequently, the FSDF soil was instead shipped to the Buttonwillow Hazardous Waste Facility with relatively little further attention.

12.2 Donated Trailers (2000)

In 1998, Rocketdyne was directed by the US General Services Administration (GSA) to make donations of DOE-owned trailers that had been used as office space for a number of Rocketdyne EH&S staff. These trailers were located in Area IV of SSFL. The trailers were donated to the Shandon School District in the Central Valley, the Wildlife Waystation in the Angeles National Forest, and Profile Structures in Santa Fe Springs.

In January 2000 EPA began its re-surveying of former radiological facilities that had been released for unrestricted use. During the survey operations, members of the community, media, legislative staff, and activists were invited by Boeing to observe the survey operations. During these visits, the donation of the trailers raised angst among the activist members of the public. These same members subsequently communicated their feelings to Senator Barbara Boxer.



On February 2, 2000, Senator Boxer wrote a letter to Secretary of Energy Bill Richardson claiming that the trailers were potentially radiologically contaminated. Senator Boxer's allegations were incorrect and inappropriate. The trailers were not used to store radioactive materials nor were they used for any operations involving radioactive materials. The buildings were not in a radiologically controlled area. They were in fact used as normal office space. There is no regulatory requirement to perform radiation surveys of non-radiological buildings. The EPA had not requested, nor was there any regulatory requirement for EPA to *"monitor [the trailers] for radioactive contamination."*

In response to this allegation, the DOE committed to perform a courtesy radiation and contamination survey of the trailers. Personnel from Rocketdyne's Radiation Safety Department performed surveys of these trailers on February 7, 10, and 11 of 2000. Reports documenting these surveys were prepared and transmitted to the DOE, who in turn forwarded them the various parties involved. The surveys demonstrated that no elevated radiation or contamination above normal background levels was detected.

Representatives from the California State Department of Health Services (DHS) Radiologic Health Branch (RHB) and the Los Angeles County Department of Health Services (Radiation Management) were also present to perform independent surveys. A letter was issued by the DHS on February 14, 2000, stating that *"the results of the surveys did not reveal any radioactive contamination or radiation levels that are different from the background radiation level."*⁸⁶

Because of the negative publicity generated by the Boxer letter, all trailers were retrieved and transported back to SSFL in February 2000. They were subsequently disposed of to the Bradley Landfill.

Subsequently soil sampling was conducted at the Shandon School on March 28, 2000.⁸⁷ The conclusions of the sampling report stated,

- *"Soil sampling and analysis was conducted in the vicinity of the former office trailer section locations, and statistical analysis of analytical results was performed to confirm that all materials related to the office trailers had been removed from the high school site , and to confirm that chemicals and radio-chemicals were not present at levels greater than background."*
- *"The results of the soil sampling and analysis, and statistical testing indicated that the presence of the trailer sections at the Shandon High School did not impact the site."*

⁸⁶ DHS-RHB, "Complaint Concerning the Rocketdyne Trailers", February 14, 2000. Available at https://philrutherford.com/SSFL/Offsite_Disposal/Donated_Trailers/dhstrailer.pdf. Accessed October 1, 2022.

⁸⁷ GRC, "Results of Soil Sampling and Analysis - Shandon High School", June 16, 2000. Available at https://www.dtsc-ssfl.com/files/lib_rcra_soils/group5/historicaldocs/PDF_Files/HDMSE00098290.pdf. Accessed October 2, 2022



The moral of the story is ... no good deed goes unpunished.

12.3 Building Demolition and Waste Disposal (2000)

On February 2, 2002, Senator Barbara Boxer wrote a letter to Secretary of Energy Bill Richardson, accusing the Department of Energy and Rocketdyne of disposing of contaminated building debris to municipal landfills and metal recyclers. The following addressed the numerous inaccuracies and falsehoods in the Senator's letter.

- Rutherford/Boeing, [Building Demolition and Disposal](#), February 21, 2000. Author Source.

12.4 Disposal of Decommissioned Material to Landfills (2002)

In 2002, the California Legislature proposed a variety of bills including SB 1970, aimed at preventing decommissioned material that had met all federal and state cleanup standards and had been "released for unrestricted use" from being disposed of at municipal landfills. Coincident with these bills, activists and legislators claimed that decommissioned material was really radioactive waste, and that Boeing was guilty of sending this radioactive waste to municipal landfills. This resulted in a storm of media, and state and local government attention.

- Los Angeles ABC TV Channel 7, [Disposal of Decommissioned Material to the Bradley Landfill](#), April 8, 2002. YouTube Source.

The process of decommissioning of radiological facilities and the subsequent "release for unrestricted use" was described in the following white papers.

- Rutherford/Boeing, [Compliance with Radiological Requirements Pertaining to Waste Disposal in the State of California](#), March 19, 2002. Author Source.
- Boeing Communications, [Recent Los Angeles City Council Resolution](#), May 2, 2002. Author Source.

12.4.1 California Integrated Waste Management Board (2002)

On April 15, 2002, Boeing wrote to the California Integrated Waste Management Board providing assurance that all decommissioned material going to landfills had been appropriately surveyed by Boeing and either the DOE, NRC, or the California Department of Health Services Radiologic Health Branch (DHS-RHB). Furthermore prior to demolition, all buildings had been released for unrestricted use. Documented evidence was provided to the Board. This letter was distributed to state, county and city legislators, and state and local agencies. As usual, Boeing received no response.

- Letter from Phil Rutherford (Boeing) to Linda Moulton-Patterson (IWMB), [Disposal of Building Debris to Landfills](#), April 15, 2002. Author Source.



12.4.2 Los Angeles City Council (2002)

On April 16, 2002, Boeing testified before the Environmental Quality and Waste Management Committee of the Los Angeles City Council.

- Rutherford/Boeing, [Radiological Cleanup of the Santa Susana Field Laboratory](#), Environmental Quality and Waste Management Committee of the Los Angeles City Council, April 16, 2002. Author Source.

On September 17, 2002, Boeing-SSFL's Director of Safety, Health & Environmental Affairs, wrote to The Honorable Nate Holden, Chairman of the Environmental Quality and Waste Management Committee of the Los Angeles City Council.

- [Letter from Steve Lafflam \(Boeing\) to Los Angeles City Councilman Nate Holden](#), Untitled, September 17, 2002. Author Source.
 - Enclosure 1. April 16, 2002, [Testimony to EQWM Committee](#). Author Source.
 - Enclosure 2. April 15, 2002, [Letter to the IWMB](#). Author Source.

12.4.3 Los Angeles Sanitation District (2002)

On September 16, 2002, the author presented data to the management of the Los Angeles Sanitation District demonstrating that disposal of decommissioned material to municipal landfills posed no hazard to disposal site workers or the public or environment.

- Rutherford/Boeing, [Radiological Cleanup for the DOE ETEC Site Closure Program \(with focus on Landfill Disposal\)](#), Presented to the Los Angeles County Sanitation District, September 16, 2002. Author Source.

12.4.4 Waste Management and Clean Harbors (2002-2003)

During the next several months, the author presented the same data to Waste Management, operators of Kettleman Hills and Clean Harbors, operators of Buttonwillow.

- Rutherford/Boeing, [Radiological Cleanup for the DOE ETEC Site Closure Program \(with focus on Landfill Disposal\)](#), Presented to Waste Management, October 9, 2002. Author Source.
- Rutherford/Boeing, [Radiological Cleanup for the DOE ETEC Site Closure Program \(with focus on Landfill Disposal\)](#), Presented to Clean Harbors, February 20, 2003. Author Source.

12.4.5 Independent Sampling of California Landfills (2002-2003)

In April 2002, California ordered the sampling of 50 California landfills and failed to find evidence of unauthorized disposal of licensed radioactive material. No evidence of



unauthorized disposal of radioactive waste was found. As examples, two reports prepared for the California State Water Resources Control Board (SWRCB) are given below.

- GeoChem Applications, [Radioactivity Sampling Report for Calabasas Landfill, Agoura, California](#), January 2003. DOE Source.
- This report stated that *"The radioactivity data collected for the Calabasas Landfill indicate no evidence of radioactive waste disposal from the Rocketdyne facility."*
- GeoChem Applications, [Results and Evaluation of Radiochemical Sampling at Six Waste Management, Inc. California Landfills](#), January 2003. DOE Source.
- This report stated that *"Landfill groundwater and leachate samples collected for this study do not appear to exhibit radioactivity levels of radiological significance, nor do they indicate the presence of the unauthorized disposal of regulated radioactive materials or waste in any of the six landfills examined."* Two of the landfills investigated were the Bradley Landfill in Sun Valley and the Kettleman Hills facility in the Central Valley, both of which had been used extensively by Boeing-SSFL for disposal of waste including decommissioned material.

12.5 Disposal of Decommissioned Material to Landfills (2004-2006)

Since the Governor's Moratorium of September 2002 (Executive Order D-62-02), Boeing had complied with the order by shipping decommissioned material to Class I hazardous waste facilities, including Kettleman Hills in California's Central Valley. This included decommissioned material from building 4059 (SNAP Ground Prototype Test Reactor) and Building 4024 (SNAP Environmental Test Facility) during the period 2004 to 2006.

On November 3, 2006, Senator Barbara Boxer wrote a letter to Secretary of Energy, Samuel Bodman, accusing DOE and Boeing of disposing of radioactive waste to the Kettleman Hills Hazardous Waste Facility. Similar accusations were leveled at DTSC by State Senator Sheila Kuehl and her activist colleague Dan Hirsch.

- [Letter from Senator Boxer to Secretary Bodman, Untitled](#), November 3, 2006. Author Source.

Contrary to Senator Boxer's belief, Boeing sends "decommissioned materials" to Kettleman Hills in full compliance with the 2002 Governor's Moratorium (Executive Order D-62-02). Boeing prepared a response and transmitted it to DOE, DHS and Kettleman Hills.

- Rutherford/Boeing, [Shipments of Decommissioned Material to Kettleman Hills](#), November 11, 2006. DOE Source.



Secretary Bodman also replied to the Boxer letter above, stating that decommissioned materials were sent to Kettleman Hills with the knowledge and approval of the DHS, and in full compliance with Executive Order D-62-02.

- [Letter from Secretary Bodman to Senator Boxer, Untitled](#), November 22, 2006. Author Source.

The November 11, 2006 Boeing paper documented the extensive surveys by Boeing, ORISE and DHS/RHB, and communications between Boeing and CDHS/RHB documenting the findings that demolition waste and remaining standing above-ground structures of Building 4024 met federal and State criteria for release for unrestricted use.

The final section of the paper stated,

- *"There have been unfounded allegations made in the past that Boeing is sending radioactive waste to the Kettleman Hills Hazardous Waste Disposal Facility. These allegations have been made by Dan Hirsch of the Committee to Bridge the Gap. This occurred in 1992, again in 2000, and now again in 2006. In the last two instances, elected officials such as State Senator Sheila Kuehl, and U.S. Senator Barbara Boxer were provided with misinformation regarding Boeing's waste disposal activities. In the 1992 case, the DHS/RHB determined that Mr. Hirsch was incorrect, and that Boeing was complying with the law. In the 2000 case, both the DHS/RHB and the Department of Toxic Substances Control (DTSC) determined that Mr. Hirsch was incorrect, and that Boeing was complying with the law. In the present case the survey process described above demonstrates that Mr. Hirsch is again incorrect, and that Boeing is complying with the law."*
- *"This is a blatant attempt to use politics to block access to legal disposal options for Boeing remediation operations in Area IV. It is a blatant attempt to force all material leaving Area IV to be managed [as] radioactive waste."* [Brackets added to correct grammar]
- *"In the larger context, agency, DOE, and Boeing reaction to these increasingly frequent and unfounded allegations by Mr. Hirsch and associates result in an enormous wasted, expenditure of time and resources by all parties. As a result, the serious work of cleanup is neglected, and its schedule suffers. This, of course, is Mr. Hirsch's objective. It is time that all parties recognize these harassing tactics for what they are and respond in a more appropriate manner."*

DTSC had been questioned about these shipments by State Senator Sheila Kuehl and Dan Hirsch and it (DTSC) therefore requested a review and response from CDHS/RHB, specifically to address the question of whether the subject waste conformed to the Kettleman Hills permit. CDHS/RHB prepared a draft response, confirming that the wastes conformed to the Kettleman



Hills permit and confirming Boeing's position. CDHS/RHB sent the draft response to the DTSC. However, the CDHS/RHB paper never saw the light of day, presumably because it did not support the Kuehl/Hirsch propaganda. Numerous enquiries to DTSC management by the author in the months following this event failed to generate any acknowledgement of the draft CDHS/RHB paper or its final disposition.

Was there a cover up???

A redacted version of the draft DHS/RHB paper is provided.

- DHS/RHB, [Analysis of Boeing Demolition Materials' Conformance to Kettleman Hills Landfill Permit](#), Redacted, November 20, 2006. Author Source.

It is worth noting that during the 15 years of trumped-up allegations from the Hirsch/Kuehl/Boxer cabal and the Los Angeles City Council, Boeing, of course, received no fines and no notices of violation for its legal disposal of decommissioned material.

12.6 Proposal to Dispose of NASA Soil to a Class I Hazardous Waste Landfill (2009)

In 2009, NASA's contractor Boeing characterized some soil at Outfall 009 in NASA's Area II as containing cesium-137 slightly above the maximum of local background levels. Boeing proposed disposing this soil to a Class I hazardous waste facility based on assessment of low dose.

- Letter from Phil Rutherford (Boeing) Gary Butner (Chief DPH/RHB), [Disposal of ISRA Outfall 009 Soil to a Class I Hazardous Waste Landfill](#). September 11, 2009. DTSC Source.

DHS replied, concurring with Boeing's proposal to ship to a Class I hazardous waste facility.

- [Letter from Gary Butner \(Chief DPH/RHB\) to Phil Rutherford \(Boeing\), Untitled](#), September 24, 2009. DTSC Source.

Notwithstanding DPH/RHB's approval to ship this soil to a Class I hazardous waste landfill, the subsequent 2010 AOC required that all NASA soil exceeding background be shipped to a licensed LLRW disposal site. [Section 7.5.1](#) on the ISRA program describes this removal action.

12.7 Demolition and Disposal of Remaining Boeing-owned Area IV Buildings (2012-2022)

One would think that the numerous false and failed allegations about offsite disposal of alleged "radioactive waste" would be the end of the story. But no!

In 2013, Boeing announced plans to demolish and dispose of the final six Boeing-owned former radiological facilities (or remnants of) in Area IV that had been decommissioned and released



for unrestricted use. All survey reports and decommissioning documentation had been provided to, and reviewed by, DTSC, CDPH/and EPA. DTSC, as lead agency for SSFL, approved demolition of the remnants of L-85. Boeing anticipated receiving similar approvals for the remainder of the buildings in shortly.

In August 2013, the Physicians for Social Responsibility-Los Angeles (PSR-LA), the Committee to Bridge the Gap, the Southern California Federation of Scientists and Consumer Watchdog sued the DTSC and CDPH as respondents and Boeing as a real party of interest, alleging that the decommissioned material was ... wait for it ... radioactive waste!!!

In 2018, this lawsuit was denied by the court on all counts. But of course petitioners appealed and as of November 2022, that appeal is still in the court.

12.8 Demolition and Disposal of Remaining DOE-owned Area IV Buildings (2020-2021)

In 2020, DTSC and DOE signed an Amendment to Order on Consent, that covered DOE-owned buildings that had been decommissioned and released for unrestricted use (4019 and 4029), met standards for unrestricted use (4133) or had no history of radiological use (4038, 4057, 4662 and 4663). DOE agreed to classify, manage, ship, and dispose of this decommissioned material and never-contaminated material as ... wait for it ... low-level radioactive waste!!!

What was DTSC and DOE leadership thinking?

12.9 Decommissioning and Disposal of Decommissioned Material

A blow-by-blow account of the impacts of legislation, litigation, and regulatory abuse on nuclear decommissioning at SSFL and disposal of decommissioned material is provided in ...

- Rutherford, [Nuclear Decommissioning at SSFL: 20+ Years of Politics vs. Science](#). Author Source.
- Rutherford, [Video of presentation at the Annual Meeting Health Physics Society, Spokane, Washington](#), July 20, 2022. YouTube Source.
- Rutherford, [PowerPoint Presentation](#), July 20, 2022. Author Source.



13.0 WILDFIRES AT SSFL

13.1 Topanga Fire (2005)

The Topanga Fire started on September 28, 2005, near the Ronald Reagan freeway in Chatsworth and burned south through the Simi Hills and SSFL, eventually contained north of the 101 Freeway. The fire burned 24,000 acres including 70% of SSFL. Boeing took the lead in SSFL post-fire response, air sampling, and communications with agencies, media, and the public.

- Boeing, [Topanga Fire - Santa Susana Field Laboratory](#), Briefing to Ventura County Air Pollution Control District, Ventura County Environmental Health Division, Ventura County Fire Department, Department of Toxic Substances control, Regional Water Quality Control Board, Department of Energy, South Coast Air Quality Management District. October 13, 2005. Author Source.
- Boeing, [Topanga Fire - Santa Susana Field Laboratory](#), Briefing to the Daily News and Ventura County Star, October 20, 2005. Author Source.
- Boeing Communications, [Boeing Santa Susana Field Laboratory Update - The September 2005 Topanga Fire](#), November 8, 2005. DOE Source.
- DOE/Boeing, [Topanga Fire](#), Public Meeting, November 15, 2005. Author Source.
 - DOE/Boeing, [Topanga Wildfire- Santa Susana Field Laboratory](#), Poster, November 15, 2005. DOE Source.

Air monitoring during and immediately following the fire plus sampling of fire ash was conducted by Boeing and data provided to the CDHS/RHB.

- Rutherford/Boeing, [Topanga Fire - Santa Susana Field laboratory - Radiological Assessment](#), October 20, 2005. Author Source.
 - [Exposure Measurements](#)
 - [Vegetation Sampling](#)
 - [Air Sampling](#)
 - [Ash Sampling](#)

No structures in Area IV were affected by the fire. Air samples taken during and after the fires did not detect any airborne release of man-made radiological materials. Ash samples did not detect any radiological contamination above approved cleanup levels.

Note that DTSC's involvement in the 2005 Topanga Fire response was minimal compared with its lead response following the 2018 Woolsey Fire.

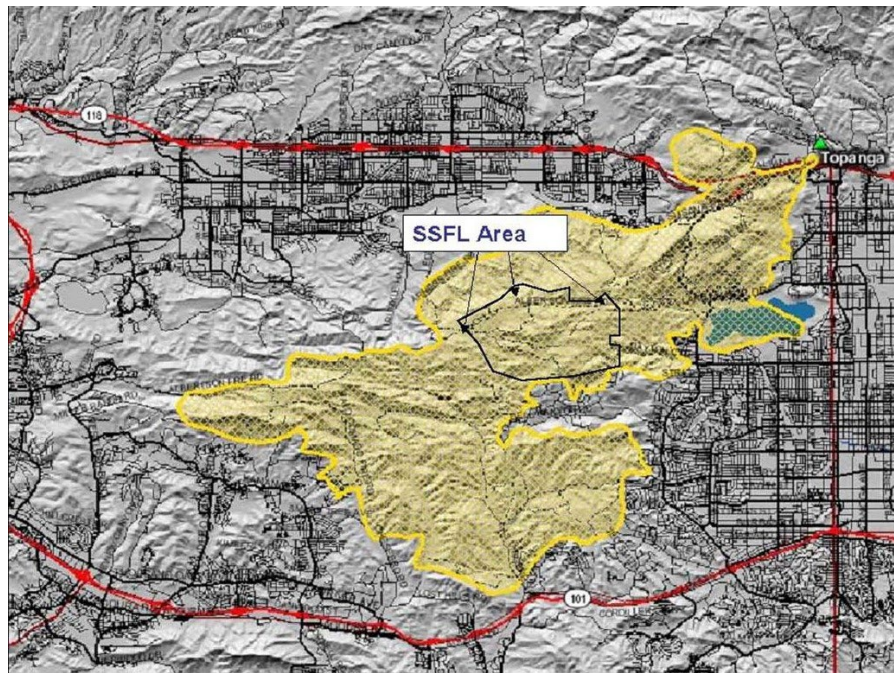


Figure 25. Topanga Fire Boundary



Figure 26. Infra-red Image of Topanga Fire



Figure 27. Area IV Buildings Escape Topanga Fire

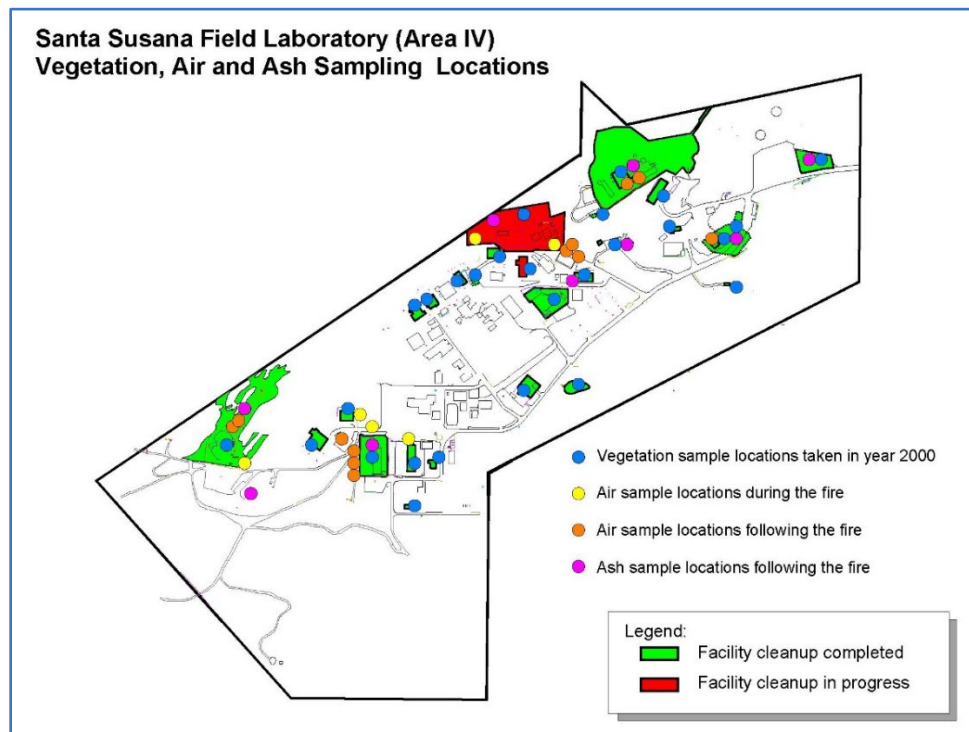


Figure 28. Vegetation, Ash, and Air Sampling



13.2 Woolsey Fire (2018)

On November 8, 2018, the Woolsey began from the northern portion of SSFL and within the next several days burnt almost 100,000 acres all the way to Malibu.

Reports investigating the potential offsite impacts of this fire were issued over the next several months.

13.2.1 Department of Toxic Substances Control Report

DTSC issued an interim report in December 2018, including assessments and data taken by a multi-agency team during the three-week period following the fire,

- California Environmental Protection Agency
- Department of Toxic Substances Control
- Office of Environmental Health Hazard Assessment,
- California Department of Public Health
- U.S. Environmental Protection Agency
- National Nuclear Security Administration, Office of Nuclear Incident Response
- U.S. Department of Energy
- DOE Rapid Assessment Unit from Lawrence Livermore National Laboratory
- California National Guard
- LA County Department of Public Health, Radiation Management
- Los Angeles County Regional Water Quality Control Board

The interim report and key conclusions of the report were,

- DTSC, [DTSC Interim Summary Report of Woolsey Fire](#), December 2018. DTSC Source.
- *"Response Team members confirmed that the SSFL facilities that previously handled radioactive and hazardous materials were not affected by the fire. Additionally, air samplers located adjacent to these buildings collected data during the fire that show radionuclide levels consistent with background levels. Based on the DTSC and Response Team members' sampling results discussed in this report, all the measurements and analyses indicate that no radiation or hazardous materials associated with contamination of SSFL were released by the fire."*

In December 2020, DTSC issued a final summary report on the Woolsey Fire. DTSC's initial conclusions remained unchanged.

- DTSC, [DTSC Final Summary Report of Woolsey Fire](#), December 2020. Author Source.
- *"This final version of the report incorporates additional data and information not available when the interim report was circulated. This final report reaches the same conclusion as the interim report: data from multiple lines of evidence did not identify a*



release of contaminants from SSFL. Like the interim report, this final report also finds the risk from exposure to smoke during the Woolsey Fire was not higher than what is normally associated with wildfire.”

Alleged Cesium-137 Contamination Plume: Although the bottom-line conclusion of the multi-agency report was encouraging, the author did take exception to one portion of the report. It was troubling that Appendix C of the Interim Report (PDF pages 75 to 79) includes a map, with no explanatory text, showing a plume of cesium-137 ground contamination originating from SSFL and spreading in a south-westerly direction covering Bell Canyon, Oak Park, Westlake Village, Thousand Oaks, Agoura Hills, Calabasas, Malibu, a wide swath of the Santa Monica Mountains, and far out into the Pacific Ocean. This map was created based on a hypothetical, theoretical, predictive calculation on November 11, 2018, approximately 36 hours after the commencement of the fire. The map’s legend attempts to lessen the shock value by explaining that the plume represents areas that are “predicted to be” 1 million to 10 million times lower than the EPA Protective Action Guidelines and that public protection actions are not warranted. This may mean something to a health physicist but would be meaningless to a member of the public and would simply confirm their beliefs that they have been contaminated with cesium-137 by SSFL and the fire.

DTSC attempts to put the significance of this predictive map of cesium-137 contamination into context on page 16 (PDF page 21) of their text, by explaining that 64 on-site and off-site environmental soil and air samples, and radiation measurements were taken and that *“... all results were consistent with natural background radiation levels ... and consistent with naturally occurring radioactive materials.”*

So, what does the map mean? The following analysis was conducted.

- Rutherford, [Alleged Woolsey Fire Cesium-137 Plume](#). January 17, 2019. Author Source.

The study concluded that,

- *“The theoretical plume concentrations are not only 100,000 to 10,000 times less than mean background cesium-137, but also less than background cesium-137 variability by a similar amount, meaning that the “contamination plume” would be indistinguishable from background cesium-137. Further, the theoretical plume concentrations are even 10,000 to 1,000 less than the capability of the laboratory to detect cesium-137. None of the cesium-137 “contamination plume” would be detectable, even it was real. This is confirmed by the failure to detect cesium-137 contamination by the DTSC multi-agency response team.”*
- *“In conclusion, the maps generated by the NNSA Consequence Management Home Team, explicitly approved by FRMAC, implicitly approved by DOE ETEC management, and published by DTSC are misleading, unrealistic, inflammatory and lack all credibility.”*



13.2.2 Los Angeles Regional Water Quality Control Board

An immediate post-fire response by The Boeing Company was to initiate repairs to the fire-impacted stormwater management equipment. The LARWQCB gave concurrence and approval for these actions.

- Letter from Renee Purdy (LARWQCB) to Dave Dassler (Boeing), [Concurrence with The Boeing Santa Susana Field Laboratory Stormwater Management Actions in Immediate Response to the Woolsey Fire](#), November 21, 2018. DTSC Source.

13.2.3 Boeing

Along with DOE and NASA, Boeing maintains a site-wide system of 12 air monitoring stations, sampling 24/7 for PM₁₀, PM_{2.5}, VOCs, and radionuclides. All except one DOE station, were in operation before, during and after the Woolsey fire and so gave a unique real-time picture of air quality during the Woolsey Fire. Boeing issued a radiological analysis of sampling data from Boeing stations on January 4, 2019. This was later supplemented on February 15, 2019.

- Letter from Mike Bower (Boeing) to Mark Malinowski (DTSC), [Revised Technical Memorandum - The Boeing Company's Radiological Air Monitoring Data Associated with the Woolsey Fire](#), February 15, 2019. Boeing Source.

The conclusion of this report was,

- *"Isotopic analysis confirmed that only naturally occurring radioactive material (NORM), including alpha-emitting radionuclides (²¹⁰Po, ²³⁰Th, and ²³²Th) and beta-emitting ⁷Be were detected. No anthropogenic (man-made), nuclear by-product radionuclides were detected in these samples, indicating residual contamination from site operations at SSFL had no impact on radionuclide air concentrations due to the fire."*

13.2.4 DOE

On November 19, 2019, DOE and its contractors completed an initial assessment of impacts from the Woolsey Fire on DOE-administered Area IV of the SSFL. This assessment confirmed that no DOE facilities were impacted by the fire although an undeveloped portion of Area IV known as Milk Vetch Hill did burn.

In June 2019, DOE issued its quarterly air monitoring report that included the days of the Woolsey Fire.

- North Wind, [Report on Quarterly Air Monitoring, Area IV, Third Quarter 2018-2019](#), June 2019. DOE Source.



Only naturally occurring radionuclides were confirmed detected for the samples taken during the fire.

13.2.5 Critique of Fairewinds Study

As usual, Hirsch and community members refused believe the numerous agencies including DTSC that sampled the environment following the Woolsey Fire and determined that it had not spread contamination from SSFL into the surrounding communities. A team from Fairewinds solicited the community to collect and submit dust samples from household A/C filters, automobile air filters, and vacuum cleaners plus any other media they believed to be contaminated from the Woolsey smoke.⁸⁸ Apparently, Fairewinds discounted the fact that air filters routinely accumulate and concentrate dust containing radioactive radon decay products in everybody's homes all the time. My own A/C filter is contaminated.⁸⁹ Even Kaltoven was smart enough to not present results of his dust filter request in his paper below.

In December 2021, Kaltoven and the Gundersens, published a curious paper in the Journal of Environmental Radioactivity in which he claims to have discovered widespread microparticles of the mineral, monazite, containing thorium in the soil surrounding SSFL.

- Kaltoven M., Gundersen M. and Gundersen A., [Radioactive microparticles related to the Woolsey Fire in Simi Valley](#), CA, October 8, 2021. NIH Source.

Key conclusions, as stated by the authors, were,

- *"Data did not support a finding of widespread deposition of radioactive particles"*
- *"Given the low percentage of dust particles ultimately found to contain significant activity ..."*
- *"None of the radioactive microparticles detected in the study included any form (radioactive or stable) of cesium."*
- *"The radioactive particles detected in this study are not definitively natural or industrial."*
- *"A significant majority of samples (97% of 360 samples) collected in the study zone registered radioactivity that matched existing area background levels."*
- *"The nuclides identified as the sources of excess radioactivity in impacted samples were predominantly isotopes of radium, uranium, and thorium."*

⁸⁸ Fairewinds, "Open Letter to the Public, November 19, 2018. Available at https://philrutherford.com/SSFL/Woolsey_Fire/2018-11-19_Santa_Susana_Woolsey_Fire_Sampling_Fairewinds_Solicitation.pdf. Accessed November 16, 2022.

⁸⁹ Rutherford, "Radiation Survey of West Hills Residence," September 4, 2013. Available at https://www.philrutherford.com/SSFL/boeing_building_demolition/Response_to_PSR-LA_Petition.pdf#page=74. Accessed November 16, 2022. A/C filters accumulate dust containing radon decay products. My A/C filter read 80,000 dpm/100cm² total alpha and 146,000 dpm/100cm² total beta, significantly exceeding Regulatory Guide 1.86 limits of 1,000 and 5,000 dpm/100cm².



Minerals such as monazite take geological timeframes to be formed and frequently require extreme temperatures and pressures in the Earth's mantle to develop. Mr. Kaltofen ignores that fact, alleging that the source of this thorium monazite was SSFL.

The author wrote a rebuttal to the Kaltofen paper.

- Rutherford, [Review of Fairewinds Study](#), October 27, 2021. Author Source.

Conclusions were,

- *"The isotopic analysis results are questionable, incomplete and appear to have inadequate, undefined DQOs. The MDAs not only exceed the measured values (indicating non-detect results) but also exceed the mean of the background, especially cesium-137 and radium-226, whose MDAs exceed background by a wide margin. Inappropriate comparison is made of isotopic maximums to mean background."*
- *"The paper does a great job of demonstrating that radioactive microparticles of thorium monazite are naturally occurring minerals of geologic age. The paper's title attempts to correlate detection of thorium monazite microparticles to the Woolsey Fire. Since thorium monazite originates from geologic age rock, any thorium monazite microparticles in the environment is due to normal weathering of that rock. Thorium monazite microparticles were not created by, the wildfire, the presence of SSFL or its operations."*
- *"A significant majority of samples (97% of 360 samples) collected in the study zone registered alpha and beta radioactivity that matched existing area background levels. The maximum alpha and beta count rates were for a sample taken at the maximum distance from SSFL, with one of the highest monazite microparticle content. This suggests that alpha and beta count rates are correlated with monazite content, and not correlated with distance from the site."*
- *"The Fairewinds Study results are inconsistent with the results of the 2012 EPA Radiological Study of Area IV of SSFL."*

13.2.6 Risk Assessment Corporation

Following the Woolsey Fire, Risk Assessment Corporation (RAC)⁹⁰ conducted offsite soil sampling around SSFL to determine if potential fire-driven airborne radionuclides had impacted the neighboring communities. RAC specializes in environmental radiological risk and dose

⁹⁰ Risk Assessment Corporation, <https://racteam.com/>. Accessed March 11, 2023



assessment. John Till, RAC's founder and Helen Grogan, co-edited the standard textbook, "Radiological Risk Assessment and Environmental Analysis" in 2008.⁹¹

RAC performed source term estimation, atmospheric transport and deposition modeling, and surface and subsurface soil sampling (during August 2019, nine months following the fire). RAC completed a report documenting its analysis in 2020.

- Rood, Arthur S. et al. [Evaluation of Off-site Impacts from the Woolsey Fire Burning on Portions of the Santa Susana Field Laboratory Site](#). October 26, 2020.⁹²

In April 2023, a paper summarizing RAC's study was published in Health Physics, the Radiation Safety Journal of the Health Physics Society (HPS). This paper is permitted to be downloaded and shared so long as the appropriate citation is used.

- Rood, Arthur S. et al. [Potential Airborne Releases and Deposition of Radionuclides from the Santa Susana Field Laboratory during the Woolsey Fire](#), April 2023.⁹³

The paper's abstract and conclusions are quoted in full.

“Abstract: *The Santa Susana Field Laboratory (SSFL), located in southern California, is a former research facility, and past activities have resulted in residual radioactive contamination in Area IV of the Site. The Woolsey Fire burned across the site, including some of the contaminated areas, on 8–11 November 2018. Atmospheric transport modeling was performed to determine where the smoke plume went while the fire burned across the SSFL and the deposition footprint of particulates in downwind communities. Any radionuclides on vegetation and in surface soil released by the fire were assumed to follow particulate matter transport path and deposition. The predicted deposition footprint was used to guide confirmatory soil sampling at 16 locations*

⁹¹ Amazon, "Radiological Risk Assessment and Environmental Analysis", https://www.amazon.com/Radiological-Risk-Assessment-Environmental-Analysis/dp/0195127277/ref=sr_1_1?crid=N9LPES7R0PTJ&keywords=Radiological+Risk+Assessment&qid=1678573615&srefix=radiological+risk+assessment%2Caps%2C128&sr=8-1&ufe=app_do%3Aamzn1.fos.f5122f16-c3e8-4386-bf32-63e904010ad0, Accessed March 11, 2023

⁹² Rood, Arthur S, Mohler, H. Justin, Grogan, Helen A, Caffrey, Emily A, Mangini, Colby, Till, John E, "Evaluation of Off-site Impacts from the Woolsey Fire Burning on Portions of the Santa Susana Field Laboratory Site." 01-SSFL-2020-FINAL. October 26, 2020. Available at https://racteam.com/wp-content/uploads/2023/05/Report-on-Evaluation-of-Offsite-Impacts-of-Woolsey-Fire-at-SSFL_FINALApps.pdf. Accessed May 5, 2023.

⁹³ Rood, Arthur S; Mohler, H. Justin; Grogan, Helen A.; Mangini, Colby; Caffrey, Emily A.; Till, John E, "Potential Airborne Releases and Deposition of Radionuclides from the Santa Susana Field Laboratory during the Woolsey Fire." Health Physics 124(4):p 257-284, April 2023. | DOI: 10.1097/HP.0000000000001665. Available at https://journals.lww.com/health-physics/Fulltext/2023/04000/Potential_Airborne_Releases_and_Deposition_of.3.aspx. Accessed March 11, 2023. This paper is open-access distributed under the terms of the Creative Commons Attribution Non-Commercial Non-Derivatives License 4.0 (CCBY-NC-ND).



including background. Highest offsite deposition was determined to be northeast of the Oak Park community, which is located about 6 km southwest of SSFL. Depth-profile sampling was used to evaluate whether radionuclides of SSFL origin were potentially emitted and deposited during the Woolsey Fire. If radionuclides had been deposited from the Woolsey Fire at sufficient concentrations, then they would be detected in the surface layer and would be expected to be higher within the plume footprint than outside it. An upper bound estimate of the hypothetical effective dose to a person in Oak Park based on measured radionuclide concentrations in soil and vegetation on the SSFL was less than 0.0002 mSv. The occurrence of naturally occurring radionuclides at concentrations above the established background for the SSFL was attributed to natural variability in geologic formations and not SSFL. No anthropogenic radionuclides were measured at levels above those expected from global fallout. The soil sampling confirmed that no detectable levels of SSFL-derived radionuclides migrated from SSFL at the locations sampled because of the Woolsey Fire or from past operations of the SSFL.”

“Conclusion: Air measurement data collected during the Woolsey Fire, along with atmospheric dispersion modeling and an offsite soil sampling program designed specifically to look for impacts from the fire, showed no evidence of SSFL impact in off-site soils because of the Woolsey Fire. Variations in anthropogenic and naturally occurring radionuclides in soil was attributed to the underlying geologic formations and geomorphology of the sampling location. Computer modeling of the fire progression identified the Oak Park community as the residential area that had the highest PM_{2.5} air concentrations and deposition while the Woolsey Fire burned on the SSFL. Oak Park is located about 6 km southwest of the SSFL, and there was no evidence of SSFL-derived radionuclides in the soils collected in this area. The confirmatory soil sampling had the ability to detect doses from atmospheric deposition of radionuclides during the Woolsey Fire that ranged from 8.2×10^{-5} mSv for ⁹⁰Sr to 2.4×10^{-2} mSv for ²³⁴U. These minimum detectable doses are substantially less than regulatory limits or doses received from natural background. The amount of activity released from the Woolsey Fire necessary to detect radionuclides in soil at Oak Park based on the modeling is greater than the surface soil inventory in Area IV at SSFL. As such, even if the entire surface soil inventory were released, annual hypothetical doses at the Oak Park community would be less than 0.0002 mSv. Soil sampling within and outside the deposition plume confirmed that no detectable levels of SSFL-derived radionuclides migrated from SSFL because of the Woolsey Fire. Moreover, no evidence was found of impacts to off-site soils from past operations at the SSFL that may have resulted in releases to the atmosphere.”



The paper also referenced the earlier Kaltofen paper,⁹⁴ and made the following comments.

- “Although the authors conclude that there is evidence of decreasing radioactivity with increasing distance from SSFL and imply that high concentrations measured as part of the study are attributable to SSFL, the information provided in the article does not support this, and the data provided are insufficient to enable readers to reproduce or validate their findings.”
- “When the count rate data presented in Tables 1 and 2 of are plotted as a function of distance from SSFL, there is no apparent trend in the data, and the highest values are seen at the most distant location.”
- “Their finding that 97% of the samples collected matched existing background levels was an important conclusion of the study, but without the spatial context of these samples relative to the samples with elevated activity, it is impossible to adequately interpret the data.”
- “Kaltofen suggests that monazite particles (a rare earth phosphate mineral that contains thorium) that were detected in the samples originated from past SSFL activities but also mentions the possibility that exposed bedrock could be a source of the monazite. The thorium content of the monazite particles identified (2.1–9.6%) was in the range that is typically found in natural monazite deposits (3.1–11.3%). The thorium used at SSFL would have been in the form of a metal oxide and not within the crystal lattice of a naturally occurring monazite mineral. Monazite is formed from igneous and metamorphic processes on geologic time scales. Sedimentary rocks formed from these processes are found in the SSFL region. Monazite has never been used or processed at the SSFL. Thus, the thorium in the monazite particles detected by Kaltofen is associated with natural materials and processes and is not from any past activities on the SSFL.”

⁹⁴ Kaltofen M, Gundersen M, Gundersen A., “Radioactive microparticles related to the Woolsey Fire in Simi Valley, CA.” *Journal of Environmental Radioactivity*, 240:106755; 2021. Available at <https://pubmed.ncbi.nlm.nih.gov/34634531/>. Accessed March 11, 2023.



14.0 EPA SUPERFUND EVALUATIONS

Section 11.0 presented several third-party evaluations of SSFL's offsite impact on surrounding communities. These were ATSDR (1999), Dan Hirsch's SSFL Advisory Panel (2006) and the Cohen UCLA Exposure Study (2006). However from a purely regulatory perspective, EPA's decision to list a site on the NPL is the "gold standard" or real indicator that a site deserves CERCLA attention and remediation. Such a site is commonly called a Superfund site.

EPA Region IX has assessed the SSFL site (or Area IV) numerous times to determine if it is eligible for listing on the National Priorities List (NPL) as a Superfund site. The following provides summaries to those assessments and is extracted from Section 12.0 of,

- Rutherford, [Nuclear Decommissioning at the Santa Susana Field Laboratory](#). Author Source.

14.1 Santa Susana Field Laboratory (1989)

On July 19, 1989, Ecology & Environment Inc. issued a report documenting its site-wide Preliminary Assessment / Site Inspection (PA/SI) of SSFL, including EPA ID# CAD093365435 (Rockwell), CA1800090010 (NASA) and CA3890090001 (DOE).⁹⁵ The report's conclusion was,

- *"A Hazard Ranking System [HRS] evaluation for the Rockwell International Santa Susana Field Laboratory indicates that the facility will probably not qualify for inclusion on the National Priorities List. This conclusion is based on the low number of drinking water targets that may potentially be affected by groundwater or surface water contamination from the facility." The report also concluded that, "The radionuclide emissions released from the facility appear to be within the guidelines established by the Department of Energy."*

Based on these conclusions, USEPA did not add SSFL to the NPL.

14.2 Former Sodium Disposal Facility (1989)

On August 18, 1989, Ecology and Environment Inc. issued a report documenting a Preliminary Assessment (PA) on the Former Sodium Burn Pit, EPA ID# CAD982399719.⁹⁶ The final PA report

⁹⁵ Energy and Environment Inc. for USEPA, Region 9, "Summary Review of Preliminary Assessments / Site Inspections of Rockwell International Santa Susana Field Laboratory", July 19, 1989. Available at <https://www.epa.gov/sites/default/files/documents/ref-15.pdf>. Accessed December 11, 2021.

⁹⁶ Energy and Environment Inc. for USEPA, Region 9, "Preliminary Assessment", August 18, 1989. Available at <https://www.epa.gov/sites/default/files/documents/ref-6.pdf>. Accessed December 11, 2021.



neither provides a numerical HRS analysis, nor provides a final HRS numerical score. The report does however conclude,

- *“Based on a preliminary Hazard Ranking System estimate, it does not appear as though the Former Sodium Burn Pit at the Rockwell International Santa Susana Field Lab will be eligible for inclusion on the National Priorities List.”*

14.3 Energy Technology Engineering Center (1993)

On September 21, 1993, PRC Environmental Management Inc. issued a final report on a PA/SI it conducted of the Energy Technology Engineering Center (ETEC), EPA ID# CA3890090001 (DOE) and CAD00629972 (Building 4133).⁹⁷ The final PA/SI report neither provides a numerical HRS analysis, nor provides a final HRS numerical score. The report makes no recommendations regarding listing ETEC on the NPL.

14.4 Energy Technology Engineering Center - Area IV (2003)

In 2003, Weston Solutions Inc. conducted a further PA/SI, on behalf of USEPA Region 9, on Area IV of SSFL (aka Energy Technology Engineering Center (ETEC), EPA ID# CA3830090001.⁹⁸ The report did not provide numerical HRS analysis, numerical HRS results or make any recommendations regarding listing on NPL. However, in December 2003, the USEPA Region 9 issued a factsheet to the public,⁹⁹ stating that,

- *“The U.S. Environmental Protection Agency (EPA) Region 9 Superfund Program has determined that the Energy Technology Engineering Center / Area IV (ETEC) site is not eligible for inclusion on Superfund’s National Priorities List (NPL), and no further response action by the Federal Superfund program is warranted at this time. This decision is based on EPA’s evaluation of radionuclide data for ETEC Area IV.”*

In this factsheet, USEPA further stated,

- *“DOE, not EPA, has the principal legal authority for making decisions and performing cleanup at ETEC. The legal explanations for this are very complex. Different laws,*

⁹⁷ PRC Environmental Management Inc. for USEPA, Region 9, “Energy Technology engineering Center, Simi Hills, California – Federal Facility Review - Preliminary Assessment / Site Inspection Final Report”, September 21, 1993. Available at <https://www.epa.gov/sites/default/files/documents/ref-22.pdf>. Accessed December 11, 2021.

⁹⁸ Weston Solutions Inc. for USEPA, Region 9, “Site Inspection Report - Energy Technology Engineering Center / Area IV, Simi Hills, California”, September 2003. Available at <https://www.epa.gov/sites/default/files/documents/ref-21.pdf>. Accessed December 11, 2021.

⁹⁹ USEPA, “EPA Concludes Superfund Evaluation of ETEC Area IV”, December 2003, Available at <https://www.etec.energy.gov/Library/About/EPAHRS.pdf>. Accessed November 12, 2022.



regulations and policies dictate when and how EPA will be involved in environmental cleanups. For the SSFL site, DOE has responsibility for the cleanup of ETEC, and final decisions about the cleanup will be made by DOE.”

- *“In 1996, the SSFL Workgroup, requested that the EPA Superfund program evaluate radionuclide data for Area IV to determine whether Area IV qualified for inclusion on the NPL. In response, the EPA Region 9 Superfund program initiated a Site Investigation for Area IV using Hazard Ranking System (HRS) criteria.”*
- *“Radionuclides associated with historic Area IV research are not present at concentrations significantly above background in the soils surrounding residential communities.”*

The HRS score was considerably less than the >25 score required for Area IV to be listed on the NPL as a Superfund Site.¹⁰⁰ ETEC is still not a Superfund site.¹⁰¹

Clearly, CBG, the California legislature, and DTSC did not like USEPA’s regulatory position as further events that unfolded in 2007 proved.

14.5 Santa Susana Field Laboratory (2007)

In July 2007, USEPA Region 9 initiated a site-wide Preliminary Assessment / Site Inspection (PA/SI) of SSFL to be performed by Weston Solutions Inc.¹⁰² USEPA issued the final PA/SI report on November 30, 2007.¹⁰³ Interestingly, the Weston Solutions report neither provided the HRS analysis, the HRS numerical result, nor recommended that SSFL be listed on the NPL. The author was unable to locate the HRS analysis on the USEPA Region 9 website, therefore a FOIA request (EPA-R9-2022-003246) was submitted to USEPA on March 22, 2022.¹⁰⁴ USEPA Region 9

¹⁰⁰ Western Solutions Inc., for USEPA, Region 9, “Summary Scoresheet for Computing Projected HRS Score”, August 9, 2003. Confidential.

¹⁰¹ USEPA, “Superfund Site Information: Energy Technology Engineering Center”, Available at <https://cumulis.epa.gov/supercpad/CurSites/csitinfo.cfm?id=0903426>. Accessed December 11, 2021.

¹⁰² USEPA Factsheet, “U.S. Environmental Protection Agency (EPA) Superfund Evaluation”, July 2007. Available at https://www.philrutherford.com/SSFL/Superfund/EPA_2007-07_SSFL_Superfund_Factsheet.pdf. Accessed December 12, 2021.

¹⁰³ Weston Solutions Inc., Prepared for USEPA Region IX, “Preliminary Assessment / Site Inspection Report - Santa Susana Field Laboratory, Simi Valley, California”, November 30, 2007. Available at <https://www.epa.gov/sites/default/files/documents/SSFL-PASI-report-r2-complete.pdf>. Accessed December 11, 2021.

¹⁰⁴ EPA, “FOIA request (EPA-R9-2022-003246)”, March 22, 2022. Available at <https://www.philrutherford.com/SSFL/EPA/EPA-R9-2022-003246.pdf>. Accessed March 26, 2022.



provided the requested material on April 18, 2022. The HRS analysis¹⁰⁵ focused exclusively on the TCE contamination of groundwater from rocket testing operations. The HRS scoresheet¹⁰⁶ quantified only pathways from TCE contaminated groundwater and surface water. The HRS scoresheet's only mention of radioactivity, states,

- *"Continuous outdoor air sampling for radioactivity is conducted along the perimeter of Area IV, however, annual exposures measured on, and off site, are below the Nuclear Regulatory Commission's annual dose limit of 100 millirem above natural background."*

Radioactivity contributed zero to the SSFL HRS score of 50.2.

Simi Valley Acorn 2007



13

Figure 29. Missing the Point

¹⁰⁵ EPA, "HRS Rationale. Santa Susana Field Laboratory. CERCLIS ID No. CAN000908498", 2007. Available at <https://foiaonline.gov/foiaonline/api/request/downloadFile/SSFL%20HRS%20Rationale.pdf/b485188e-d6ae-4cc8-b909-85ffba9cbfc1>. Accessed May 3, 2022.

¹⁰⁶ EPA, "Summary Scoresheet for Computing Projected HRS Score. Santa Susana Field Laboratory. EPA ID #: CAN000908498", October 1, 2007. Available at <https://foiaonline.gov/foiaonline/api/request/downloadFile/SSFL%20HRS%20Scoresheets%20r1.pdf/bee7fa42-9369-4319-8df3-1b166d950137>. Accessed May 3, 2022.



Every time that nuclear operations in Area IV were evaluated in isolation, EPA determined that those operations did not warrant making Area IV a Superfund site. The final 2007 evaluation included the whole SSFL site and chemical TCE groundwater contamination was the reason EPA judged SSFL warranted being listed as a Superfund site. Radionuclides again contributed a negligible amount to the HRS scoresheet. Therefore the picture at the right of the cartoon that now includes a radiation symbol, completely missed the point and misled the public.

14.6 Political Shenanigans (2007-2008)

On December 6, 2007, less than a week after the Weston Solutions PA/SI, USEPA recommended to Arnold Schwarzenegger, Governor of California, that SSFL be put on the Superfund National Priorities List (NPL).¹⁰⁷ USEPA requested a 30-day concurrence from the State of California.

Activists, legislators, and the public initially rejoiced in the anticipation of SSFL becoming a Superfund Site.¹⁰⁸ Dan Hirsch, of GBG, is quoted in the Daily News article above as saying,

- *“The community has been praying for a decade that this site would be added to the Superfund list. If the governor blocks Superfund listing, he would be doing a favor to the polluter and a grave injustice to the people who live near the site.”*

Only twenty-five days later, Dan Hirsch, along with a multitude of other activist organizations changed their tune, and demanded that the State defer supporting Superfund listing, preferring instead the more restrictive “agricultural land use” requirements of SB 990 to the “reasonably anticipated future land use” requirements of CERCLA guidance, and ultimately preferring the “cleanup-to-background” requirements of the 2010 AOC.

On January 4, 2008, the Los Angeles Regional Water Quality Control Board (LARWQCB) wrote to CalEPA supporting listing SSFL on the NPL.¹⁰⁹

On January 15, 2008, CalEPA sent a letter to USEPA requesting a six-month deferment on Superfund listing.¹¹⁰

¹⁰⁷ EPA Letter to Governor of California, “Santa Susana Field Laboratory, Ventura County, California”, December 6, 2007. Available at <https://www.etec.energy.gov/Library/Main/dec6letterepassfl.pdf>. Accessed December 9, 2021.

¹⁰⁸ Daily News, “Arnold Holds Key to Site’s Superfund Listing”, December 21, 2007. Available at https://www.philrutherford.com/SSFL/Superfund/DailyNews_2007-12-21.pdf. Accessed December 2021.

¹⁰⁹ LARWQCB Letter to Cal EPA, “Superfund National Priorities List Placement - Santa Susana Field Laboratory (NPDES No. CA0001309)”, January 4, 2008. Available at https://www.philrutherford.com/SSFL/Superfund/LARWCB_12-12-2008.pdf. Accessed December 9, 2021.

¹¹⁰ CalEPA Letter to USEPA, “Santa Susana Field Laboratory, Ventura County”, January 15, 2008. Available at https://www.philrutherford.com/SSFL/Superfund/Nastri_SSFL_011508.pdf. Accessed December 11, 2021.



In March 2008, USEPA issued a factsheet to the public, confirming that SSFL qualified to be a Superfund site.¹¹¹ It is noteworthy however that USEPA still did not provide the numerical results of the hazard ranking system (HRS) used to determine eligibility.

In July 2008, the California Environmental Protection Agency (CalEPA) sent a second request to USEPA requesting a delay in listing SSFL as a Superfund site.¹¹²

On October 10, 2008, DOE wrote to USEPA supporting listing SSFL on the NPL,¹¹³ noting that oversight by USEPA, together with an established risk based CERCLA remediation was appropriate.

The author is unaware of any final written decision by USEPA to not list SSFL on the NPL. As of the publication date of this paper, SSFL has still not been listed on the NPL.¹¹⁴

¹¹¹ EPA, “Superfund Eligibility Evaluation of Santa Susana Field Laboratory has been Completed”, March 2008. Available at https://www.epa.gov/sites/default/files/documents/SSFL3_08Legal.pdf. Accessed December 9, 2021.

¹¹² Cal EPA Letter to EPA, “Santa Susana Field Laboratory, Ventura County”, July 11, 2008. Available at https://www.philrutherford.com/SSFL/Superfund/CalEPA_2nd_Extension_Request.pdf. Accessed December 9, 2021.

¹¹³ DOE Letter to EPA, October 10, 2008. https://www.etec.energy.gov/Library/Main/Signed-Response_letters_to_2008-1611%5B1%5D.pdf. Accessed December 9, 2021.

¹¹⁴ USEPA, “Superfund Site Information: Santa Susana Field Laboratory”, Available at <https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0908498>. Accessed May 3, 2022.



15.0 MISCELLANEOUS STAKEHOLDER OUTREACH

SSFL has opened up its doors to the public, the media, state & federal agencies, wildlife associations, tribal leaders, and local, state, and federal legislators. Many of these stakeholder visits have included narrated bus tours. Individual and smaller group tours have included briefings. Topics discussed included cleanup & waste disposal, the SRE, community health studies, and issues of the day. A selection of this stakeholder outreach briefing material is provided in Table 9.

Table 9. Miscellaneous Stakeholder Outreach Briefings

Title	Date	Audience	Site Tour
Briefing to NCMA	09/21/2000	National Contract Management Association	
Briefing to VICA	10/05/2000	Valley Industry & Commerce Association	
ATSDR/ERG/UCLA Visit	10/13/2000	ATSD, ERG and UCLA	Yes
EPA Survey of Building. 4059	10/24/2000	CBG, SSFL Work Group, community members, media, legislative staffers, DTSC, EPA, Tetra-Tech	Yes
EPA Survey of Buildings 4011, 4019, 4055 and 4100	10/02/2001	CBG, SSFL Work Group, community members, media, legislative staffers, DTSC, EPA, Tetra-Tech	Yes
SSFL Radiological Topics	10/10/2006	Simi Valley City Council	
SSFL - General SSFL - Radiological	11/08/2006	Chief of Staff & District Manager of State Senator Sheila Kuehl	Yes
Radiological Topics	11/12/2006	Bell Canyon Town Hall Meeting	
DOE Closure of the Energy Technology Engineering Center Thank you letter from Sen. Boxer	01/19/2007	Adolfo Bailon, Senior Field Representative, US Senator Barbara Boxer	Yes
Santa Susana Field Laboratory	07/24/2007	State Assemblyperson Cameron Smyth	Yes
EPA Tour of SSFL	03/11/2008	EPA Region IX	Yes
Area IV SSFL ETEC (Hosted by DOE)	04/25/2008	Julia Brownley, State Assemblyperson and Other Elected Official Staffers	Yes
Radiological Operations and Cleanup at SSFL, Area IV - ETEC Closure Project	03/12/2009	Southern California Chapter of the American Industrial Hygiene Association	
Site Tour - SSFL	06/18/2012	EPA Superfund National Radiation Conference Attendees	Yes



Title	Date	Audience	Site Tour
Congressional Site Tour and Project Close-Out for EPA's Radiological Characterization Study at the SSFL	09/12/2012	EPA Region IX Executive Staff and California and Federal Legislative Staffers	Yes



16.0 MEDIA

Print, TV, and social media have played a major role in spreading disinformation about SSFL. At the outset the Daily News was the flag bearer of anti-SSFL stories, followed later by the Ventura County Star and The Acorn. The LA Times was a little more circumspect, preferring to take a more balanced position. Local Los Angeles NBC affiliate, Channel 4 was the TV equivalent of the Daily News. With the rise of the internet, anti-SSFL websites proliferated as did electronic yellow journalism, such as Michael Collins' EnviroReporter.com.

Boeing employees, including the author, have occasionally responded to inaccuracies, misinformation, and bias in print media by sending letters to the editor and occasionally editorials. Many were published, some were not. Some are provided below from 1999 to 2002.

- Tom Sella, [Lung Cancer Rate Near Rocketdyne](#), Los Angeles Times, April 25, 1999
- Byron Wood, [Good Science is Rocketdyne's Strength](#), Los Angeles Times, October 24, 1999
- Simi Valley Star Editorial, [Progress Is Welcome](#), January 17, 2000
- James Lang, [Environmental Cleanup at Rocketdyne](#), Los Angeles times, August 20, 2000
- Ganesan Subbaraman, [It's Our Money](#), Daily News, September 12, 2000
- Phil Rutherford, [Politics and Rocketdyne](#), Los Angeles Times, October 8, 2000
- Phil Rutherford, [A Question of Evidence](#), Uncut, unpublished version of Politics and Rocketdyne
- Phil Rutherford, [Psychology and Rocketdyne](#), Unpublished letter to Los Angeles Times, October 12, 2000
- Phil Rutherford, [Rocketdyne Studies](#), Los Angeles Times, October 29, 2000
- Jim Cusack, [Unrealistic Perspective](#), Daily News, January 31, 2002
- Jim Cusack, [Unrealistic Perspective](#), Daily News, Uncut, unpublished version.
- Phil Rutherford, [Response to "City Council Calls Rocketdyne Cleanup Plan a Health Risk"](#), Unpublished letter to Los Angeles Times, February 2, 2002
- Jack Atnip, [Good Neighbor](#), Daily News, April 9, 2002
- Blythe Jameson, [Earthly Secrets - Rebuttal to Michael Collins' Misinformation](#), Los Angeles Weekly (Online), July 3, 2002
- Jim Cusack, [Extreme Measures](#), Daily News, August 14, 2002



17.0 CARTOON HUMOR

No area of contemporary life is free from cartoon humor and SSFL is no exception. Three cartoons were shown on previous pages and several more are shown below with appropriate acknowledgement of the source. We had a good laugh, knowing they were a joke. Of course, those with no sense of humor believed they were true.

- Various, [Santa Susana Cartoons](#). Author Source.



18.0 STRAIGHT TALK

If you have made it this far, you may have noticed occasional personal observations and undiplomatic comments salted throughout the technical discussions that would not have passed the corporate censor.

So, If you don't like to hear the truth, then do not read any further.

In the numerous public meetings, over the last 30 years, the responsible parties, Boeing, DOE and NASA and the various regulatory agencies have presented the facts to the public. In turn, other "stakeholders" have blasted back, calling us liars, felons, baby killers, using inuendo, hyperbole, vitriol, personal ad hominem attacks, outright lies, and memorable media soundbites such as ... witch's brew ... outraged ... worst nuclear disaster in US history. Corporate and agency communication policy forbids us from firing back in the same tone. However, retirement provides me with a little more freedom to speak the truth.

18.1 Thou Doth Protest Too Much, Methinks¹¹⁵

Mr. Hirsch initially lived and worked in Los Angeles in the 1970s and early 1980s, so could conceivably be classified as a concerned local citizen at that time. However he soon moved to work in UC Santa Cruz and currently resides in Ben Lomond in Northern California. For many decades he can no longer be considered a concerned community member, "concerned for his own safety."¹¹⁶

In contrast, many of SSFL's detractors are true neighbors, living in the local communities, as have I, for the last 44 years (Woodland Hills, Chatsworth, and West Hills). I worked in the De Soto facility for 12 years and at SSFL for 25 years. I am intimately familiar with the totality of radiological sampling and monitoring data, both onsite and offsite, and the numerous worker and community health studies, perhaps better than any. I have raised my family within 3 miles of SSFL without any concerns for their safety and have not thought of moving once, even during my retirement.

I am not aware of any of the long-term neighbors, Dawn, Marie, Holly, Barbara, Bonnie, Liz, Christina, D'Lanie or Melissa, who have moved homes because of their proximity to SSFL. They all still live in the community. I have met all these ladies except for Melissa. Surely, if they really

¹¹⁵ Misquoted from Shakespeare's Hamlet, Act III, Scene ii. The exact quote is, "The lady doth protest too much, methinks?" I removed the gender reference to avoid being accused of highlighting that there is an overabundance of females opposed to SSFL. Hirsch himself, Michael Collins and Adam Salkin are notable exceptions. Where are all the husbands, while their wives are having fun at the public meetings? They are remarkably absent and silent.

¹¹⁶ An anecdotal story is that after one of Mr. Hirsch's very few visits to SSFL, he was seen changing his clothing after leaving the site and placing them in a plastic bag. I cannot verify the truth of this story, but it does not sound unreasonable, given Mr. Hirsch's penchant for the dramatic.



and truly thought that they and their families had been, are being, and will be, exposed to life-threatening contamination from SSFL, that has, is, and will, impact their health, wouldn't they have moved?

They either don't really believe the allegations, or they do believe the allegations but have judged that the hassle, inconvenience, and costs of moving outweigh the alleged danger to their families. It's either one or the other. Which is it?

OK, OK, I can just hear the outraged response. "Why should we move?" "Boeing, DOE, and NASA should cleanup up to background!" But even if that could happen overnight, that would only eliminate your concerns over potential future exposure from SSFL. You all believe that the whole community is already contaminated, and that you are all getting sick. "Full" cleanup of the site will not eliminate your past, present and future concerns about alleged past and alleged current contamination of your neighborhoods. You disbelieve all the agency-vetted offsite sampling data and disbelieve DTSC when it says ...

- *"To date, DTSC has not found any evidence that contamination from research and testing operations at SSFL has posed or would pose a threat to human health and the environment outside the SSFL site boundaries."*¹¹⁷

Would you want DTSC to mandate that all your homes be torn down and shipped off to a low-level radioactive waste dump, as it did with the last four non-radiological DOE buildings in Area IV?¹¹⁸ I don't think so!

Methinks thou doth protest too much.

At the risk of overdoing the Shakespeare quotes, a friend and colleague and resident of the neighboring Bell Canyon, made a comment 30 years ago, that all the fuss about SSFL was *"much ado about nothing."*¹¹⁹

18.2 Why Is Cleanup Taking So Long?

Your continued cries for cleanup to be completed fails to recognize that a major reason why cleanup has not already been completed, is the lawsuits¹²⁰ filed by the Committee to Bridge the

¹¹⁷ DTSC, "Offsite Investigations Overview", April 2018. Available at https://www.dtsc-ssfl.com/files/lib_pub_involve/meeting_agendas/meeting_agendas_etc/67734_Update_Regarding_Offsite_Investigations.pdf. Accessed August 29, 2022.

¹¹⁸ Rutherford, "Nuclear Decommissioning at the Santa Susana Field Laboratory." https://philrutherford.com/SSFL/Nuclear_Decommissioning_at_SSFL.pdf#page=79. Section 23.0. Accessed August 22, 2022.

¹¹⁹ Shakespeare's comedy, "Much Ado About Nothing." 1598-1599.



Gap (CBG), the Natural Resources Defense Council (NRDC), the Physicians for Social Responsibility (PSR), the Southern California federation of Scientists (SCFS) and Consumer Watchdog (CW), the very organizations that you think are protecting you. The second major reason is the plethora of legislation out of Sacramento attempting undermine the nuclear decommissioning process at SSFL.¹²¹ The third major reason is the public's insistence on having input (and incorrectly implied approval) into every step in the cleanup process. That slows things down tremendously.

Of course, Mr. Hirsch's interest does not coincide with yours. He is not interested in completion of cleanup. Continued conflict is where he thrives. This is his source of income.

18.3 Epidemiology and Epidemiologists

Epidemiological studies are generally conducted because there is a pre-conceived belief that exposure to an agent has a detrimental impact to those parties exposed.¹²² This could be cell phones, hot dogs, or radiation from SSFL. The investigators will not enhance their reputation if they find nothing. A negative finding (i.e. no finding) will not make the headlines in the lay media or in the academic field. The investigator is therefore under pressure to find something, however small. The investigator slices and dices the data hundred different ways until he/she finds a few rate ratios that exceed 1.0 by a significant amount. The investigators decide what is significant. They ignore the preponderance of evidence where rate ratios are close to 1.0 or less than 1.0, or significantly less than 1.0, and cherry pick those rate ratios in isolation what they define as significant.

18.3.1 Community Health Studies

This pre-conceived bias and the desire to focus on a small fraction of positive associations is starkly illustrated by comparing the DHS census tract study of 1992 and the Morgenstern census tract study of 2007. DHS honestly discussed both positive and negative associations, looked for consistent patterns in time periods, geographical locations, and gender, and acknowledged when they found no consistent pattern. Morgenstern, in contrast, focused on the few positive associations, ignoring the negative associations, ignoring the preponderance of evidence, and ignoring the lack of consistency in time, location, ethnicity and gender.

¹²⁰ Rutherford, [Nuclear Decommissioning at the Santa Susana Field Laboratory](#), Sections 4.0, 9.0 and 19.0..

¹²¹ Rutherford, [Nuclear Decommissioning at the Santa Susana Field Laboratory](#), Sections 3.0, 5.0, 7.0, 8.0 and 11.0.

¹²² See [Section 10.1](#) where the objectives of the DHS studies were to investigate activists' and public's belief that radiation was causing increased cancer rates. The studies' results actually proved that belief to be incorrect.



18.3.2 Worker Health Studies

The difference between John Boice and Hal Morgenstern is that John Boice had already established his reputation as a world-renowned radiation epidemiologist and had nothing to prove.¹²³ In contrast, to my knowledge, Hal Morgenstern, and his co-investigator, Beate Ritz had never conducted a radiation epidemiology study before the Rocketdyne Study, leading one to wonder how they had even been given the contract. Indeed, a review of their published papers indicates they have never conducted another worker epidemiology study involving radiation exposure since.^{124,125}

18.4 Politics and Politicians

Politicians are getting a bad rap these days, perhaps undeservedly, perhaps deservedly. Local, state, federal and global problems are not easy to solve. But they have chosen that career path, perhaps following the “public servant” myth, perhaps searching for power and influence over the masses, who can say?

Unfortunately many US, California and local politicians have proved to be easily manipulated by anti-nuclear and anti-SSFL propaganda, pandering to radiation paranoia.

The reader has probably noticed a couple of politician’s names that have repeatedly come up in the preceding pages ... Sheila Kuehl, and Barbara Boxer.

They became Hirsch’s State and federal mouthpieces, pandering to his every wish. They were truly “puppets on a string.”¹²⁶

¹²³ ICRP, “John Boice”, Available at https://www.icrp.org/cv/%7B2A6A529B-0533-401A-B64B-61055E23BF80%7D/Boice_CV.pdf. Accessed August 21, 2022

¹²⁴ University of Michigan, ‘Faculty Profile - Hal Morgenstern PhD’, Available at <https://sph.umich.edu/faculty-profiles/morgenstern-hal.html>. Accessed August 21, 2022.

¹²⁵ UCLA, “Faculty - Beate Ritz”, Available at <https://ph.ucla.edu/faculty/ritz>. Accessed August 21, 2022.

¹²⁶ YouTube, Elvis Presley with roles reversed, “Puppet on a String.”
<https://www.youtube.com/watch?v=c2bI5ZgSagk>



Political Attention



2

Figure 30. Political Attention from Kuehl and Boxer

18.4.1 Sheila Kuehl

Ms. Kuehl was an actor, lawyer and then became a perennial politician, elected to the California Assembly (three terms) and then the California Senate (two terms). After being termed out she was appointed to the California Integrated Waste Management Board for a short time, and then elected to the Los Angeles County Board of Supervisors for two four-year terms. She is now be retired.

Kuehl has undoubtedly championed many worthy causes during her political career, including health care, gay rights, and workplace rights. Unfortunately she also fell under the spell of Dan Hirsch's silver tongue, acting as proxy for many of his California legislative bills and ghost writing his complaining letters to state agency leaders. Interestingly, none of her anti-SSFL activities, or indeed any environmental interests, are mentioned in her extensive [Wikipedia biography](#). Which perhaps goes to prove that the SSFL story was, and is, a storm in a teacup.



18.4.2 Barbara Boxer

Ms. Boxer was elected to the US House of Representatives in 1982 and then the US Senate in 1992 serving four six-year terms until her retirement in 2016. Like her California comrade, Boxer was easily influenced by Dan Hirsch, joining him on many anti-nuclear and anti-SSFL crusades, ghost writing his complaining letters to federal agency leaders. Boxer certainly had an interest in the environment, chairing the Senate Committee on Environment and Public Works for seven years. Indeed, during her tenure she invited Dan Hirsch (or did he invite himself?) to testify before her committee on the “dangers” of Santa Susana.

Like Kuehl, Boxer’s extensive [Wikipedia biography](#) has no mention of her anti-SSFL stance.

Hirsch truly had a strong pair of state and federal politicians in his pocket.

18.4.3 Other Politicians

Other politicians (with their one-time positions) who took advantage of the anti-SSFL bandwagon were and are.

- Elton Gallegly, US Representative
- Diane Feinstein, US Senator
- Gloria Romero, California State Senator
- Linda Parks, Ventura County Supervisor
- Julia Brownley, California State Assemblyperson, US Representative
- Fran Pavley, California State Assemblyperson and Senator, Mayor of Agoura Hills
- Nate Holden, California State Senator, Los Angeles City Councilman

Appearing as knights in shining armor, riding white horses, always plays well with the electorate.

18.6 Real Estate Disclosures

For approximately the last 30 years, prospective home buyers looking to purchase property or homes within an ill-defined distance from SSFL have been provided with a disclosure statement informing buyers of the environmental issues involving SSFL. The current disclosure statement for the San Fernando Valley is.

- Southland Regional Association of Realtors, [San Fernando Valley Local Area Disclosure and Advisory](#), Revised March 24, 2022, SRAR Source.

This disclosure form states,

- *“Boeing Rocketdyne Santa Susana Facility: Buyer is aware that there is a former Rocketdyne testing facility located in the Santa Susana Mountains between Chatsworth and Simi Valley. The*



U.S. Department of Energy has indicated that there are some radioactive materials and industrial solvents on this site. Lawsuits have been filed alleging that the Rocketdyne facility has caused environmental contamination beyond the site. Two recent studies by UCLA and the University of Michigan have indicated that residents living within two miles of this facility may have been exposed to toxic chemicals and have slightly higher cancer rates than people in communities farther from the lab. However, authors of both reports have warned the results of these studies do not conclusively show that contamination from this facility caused cancer or other illnesses in the surrounding community. The Seller and Real Estate Brokers are unable to give any definitive answers regarding potential health hazards that may result from the proximity of the Property to this former testing facility. Buyer is advised to conduct an independent investigation of this matter. It is strongly recommended that Buyer have a soil test conducted of the Subject Property to determine any potential contamination."

The disclosure could hardly be more explicit, referring to lawsuits, alleged offsite contamination and cancer, and even specific references the Cohen exposure and Morgenstern cancer studies. Anyone buying real estate in the general vicinity within the last 30 years, has done so with the full knowledge of the controversy surrounding SSFL. Presumably the attraction of the western LA County and eastern Ventura County areas had overcome whatever misgivings prospective homeowners may have had reading the alarmist disclosure.

18.7 Anti-Nuclear Movement

The anti-nuclear movement started as an anti-nuclear weapons movement ... Ban-the-Bomb. But it quickly broadened into an anti-nuclear power movement. The impact of a nuclear war is undeniably horrendous to even think about, much less experience. And the beneficial use of radiation and radioactive materials in medicine and industry is accepted by even the anti-nukers. However, the peaceful uses of nuclear energy for electricity generation proved to be a target to tempting to resist.

Reviewing the Wikipedia page on the "[Anti-Nuclear Movement in the United States](#)", I was somewhat surprised to not see any reference to the Committee to Bridge the Gap, Dan Hirsch, the SRE, or SSFL. There was plenty of reference the leading anti-nuclear personalities, organizations, their targets, and nuclear accidents ... but no mention of Dan. I'm so sorry if he feels left out in the cold.

18.8 Our Children

On page one of the hypothetical "Anti-Nuclear Activism 101", it recommends repeating the phrase ... there is no safe level of radiation ... over and over again. On page two it says ... include the words radiation and cancer in every sentence you say or write. In the early days these two rules were followed to the letter. The focus was on the deadly radiation/radioactivity released from the SRE. The main outspoken female community members at the time, were cancer



survivors. Then they read page three ... include radiation, cancer, and children in everything sentence you say. That will be the death blow to the polluters.

First, there were accusations of retinoblastoma in children. That was effectively disproven in [Section 10.4](#) by studies focused on the disease, and all other community cancer studies that failed to identify retinoblastoma, or other childhood cancers as an issue. In the words of Morgenstern, *“There were too few childhood cancers to yield informative results.”*

Then came the teens.

18.8.1 Teens Against Toxins

Teens Against Toxins (TAT) formed in a high school in the Westlake/Agoura Hills area in 2010. It is good that young people are passionate about social, political, and environmental issues. Unfortunately these teens had been subverted by parents, teachers, and Dan Hirsch.

Cindy Gortner was a realtor, and part-time community activist from Ventura County. She supported her 15-year-old daughter, Devyn, and classmates when they formed Teens Against Toxins. One of the group’s first projects was to hold “Bake Sale Meltdown.” They raised \$99.31 which they attempted to present to Boeing to *“assist with the cost of cleanup”* at a well-publicized media event.¹²⁷ It was a cute attempt to embarrass Boeing, and probably worked.



Figure 31. Teens Against Toxins Donating \$99.31 Check to Boeing
(Courtesy VCReporter)

¹²⁷ VCReporter, “Students take the Lead on Fundraising Efforts”, February 9, 2010. Available at https://www.vcreporter.com/news/students-take-the-lead-on-fundraising-efforts/article_a00c7e80-46af-5c2f-b760-9d219ff4df48.html. Accessed November 1, 2022



Boeing declined the generous donation but invited the students and their parents to a site visit and tour at a later date. I remember the tour well, making a presentation and narrating the Area IV portion of the bus tour. Of course the outreach did little to change the misguided beliefs of the parents and students. I remember one of the students who was particularly engaged, Ryan Moorman. At that time, I believe TAT had an active website, and Ryan posted a draft description of the visit/tour shortly afterward. The TAT website no longer exists and neither does Ryan's description, except here,

- Moorman, [The Santa Susana Field Laboratory](#), March 22, 2010. Author Source

I found the most amusing section at the top of page two. TAT had a conference call with Dan Hirsch, the night before the tour, who warned them about Phil Rutherford who would "*twist the story*." Well we all know that Dan is the master of "*twisting the story*", to put it mildly.

Other than a couple of YouTube videos of the bake sale, TAT did not generate much web content until an invitation from Dan Hirsch to make a presentation at the February 4, 2015, SSFL Work Group Meeting. Cindy's son, Davis Gortner, and Chloe Wigul, then current Co-Presidents of TAT, made a presentation on "Environmental Concerns about the Santa Susana Field Laboratory" that is posted on YouTube.¹²⁸

Little current information is available on the web about Teens Against Toxins, suggesting that they have moved on to more important life events, like university, careers, and families of their own.

18.8.1 Melissa Bumstead

Then came Melissa. In Melissa, Dan has met his match. Melissa was articulate, a mother, much younger than the aging anti-SSFL cohort, an accomplished graphic designer, web designer and social media user. What she lacked in Dan's technical knowledge she made up for in energy and passion. And Melissa had a daughter, Grace with cancer!

You have probably seen Melissa's website, [Parents Against Santa Susana Field Lab](#) and her feature film [In the Dark of the Valley](#). A slick, high-tech, professional production that definitely tugs at the heart strings. Don't get me wrong. I have every sympathy with parents with children with cancer and other serious illnesses. I have every sympathy for Melissa and Grace and am glad that Grace appears to be in remission. I donate every month to Shriners Children's Hospital, St. Jude's Children's Hospital and Operation Smile, and am thankful that my kids, now grown, did not have any serious illnesses, when young. However, I definitely do not share Melissa's belief that Grace's cancer or anyone else's cancer was caused by Santa Susana, as the evidence presented in this paper has demonstrated.

¹²⁸ YouTube, "Overview of Environmental Concerns about the Santa Susana Field Laboratory (Rocketdyne). Available at <https://www.youtube.com/watch?v=McPvGhi9sUY&t=9s>. Accessed November 1, 2022.



Toxic Map

Let us take a closer look at Melissa's [Citizen's Toxic Mapping Project](#). This portrays self-reported data of cancers and auto-immune disease within 15 miles of SSFL. Actually, those in Camarillo are 25 miles from SSFL. At first glance, it appears alarming. So many cancers clustered around SSFL. But then one asks oneself, why does the rest of Southern California appear to be cancer free? Of course, the answer is that the wider surrounding communities are not cancer free. Because Melissa solicited self-reported information from community members living within 15 miles of SSFL who have cancer, of course the data appears to be clustered around SSFL. In reality, if Melissa had plotted all cancer registry data for the whole Los Angeles and Ventura Counties, the density of cases would have appeared to be uniform density or at least proportional to the population density, with no contrived cluster surrounding SSFL. Good try Melissa.

Melissa's crusade has understandably focused on Grace's childhood cancer and that of other children with cancer. However, that leads to the second observation from this map. Most (73%) of the dots on the map are actually cancers in adults as evidenced by the pull-down menu on the left side of the map.

Melissa says she lives less than 5 miles from SSFL. That means that she lives in the 2 to 5 mile annulus used by Morgenstern. If she had lived less than 2 miles from SSFL, I am sure she would have said so, in order to use Morgenstern's results to further support her claim. Morgenstern used >5 miles as the assumed unexposed, baseline, with <2 mile and 2-5 mile as his assumed exposed radii. Melissa has chosen <15 miles as her assumed exposure radius. Therefore Melissa's assumed exposure radius is 9 times the area of Morgenstern's assumed exposure area and an additional 628 square miles of Morgenstern's referent, assumed unexposed area.

$$\pi 15^2 / \pi 5^2 = 9$$

$$\pi 15^2 - \pi 5^2 = 628 \text{ square miles}$$

Clearly Melissa should have consulted with Morgenstern before designing her Toxic Map.

Where is the Leukemia Data?

It is instructive to look at the past community cancer studies to try and find any data that would support Melissa's belief that Grace's leukemia has been caused by radiation from SSFL.

Morgenstern (2007)

Morgenstern ([Section 10.6](#)) included in his radiosensitive group, lung, female breast, thyroid, bone, and leukemia (excluding CLL). Morgenstern found *"little or no association between residential distance from SSFL and the incidence of ... the group of radiosensitive cancers."* Rate ratios and confidence intervals for the two time periods for the 2 to 5-mile distance were,



Table 9.	1988-1995	2-5 miles	1.03 (0.96, 1.11)
Table 10.	1996-2002	2-5 miles	0.96 (0.90, 1.03)

Morgenstern's cancer specific rate ratios and confidence intervals for lymphopoietic cancers (incl. leukemia) for the two time periods and the 2 to 5-mile distance were,

Table 11.	1988-1995	2-5 miles	0.93 (0.78, 1.10)
Table 12.	1996-2002	2-5 miles	1.01 (0.86, 1.18)

Granted that these time periods are before Grace was born, but where is the elevated leukemia in this data?

Department of Health Services (1992)

DHS ([Section 10.1.2](#)) included leukemia into its "Very Radiosensitive" group. DHS concluded,

- *"These follow-up analyses suggest that people living near the SSFL are not at increased risk for developing cancers associated with radiation exposure."* Page 6.
- *"Very Radiosensitive Cancers [thyroid, bone and leukemias except CLL]: There is no evidence to suggest that those types of cancer that would most likely to have radiation exposure as a major contributing cause occurred more commonly among residents in either Ventura or Los Angeles County who live near the SSFL." "These data suggest that, if anything, the incidence of these cancers may actually have been lower among people living near SSFL during the years covered."* Page 7.
- *"We would expect that if the community exposure to ionizing radiation were causing an elevation in cancers in this geographic area we would see the greatest increase among those cancers known to be most strongly associated with radiation exposure. Not only is such a pattern not evident, but the very radiosensitive cancer group appears to be somewhat underrepresented among people living near the SSFL."* Page 8.

Standardized incidence ratios (SIR) and proportional incidence ratios (PIR) plus confidence intervals for the very radiosensitive cancers (including leukemia) within a 5-mile radius of SSFL for two time periods for females are,

Table 2.	1978-1982	Female	0.97 (0.62, 1.45)	SIR	
Table 2.	1983-1988	Female	1.10 (0.76, 1.53)	SIR	
Table 4.	1988-1989	Female	1.00 (0.62, 1.60)	PIR	
Table 5.	1988-1989	Female	0.66 (0.28, 1.54)	PIR	Ventura County
Table 5.	1988-1989	Female	1.05 (0.59, 1.85)	PIR	Los Angeles County

Granted that these time periods are before Grace was born, but where is the elevated leukemia in this data?



Tri-Counties Regional Cancer Registry (1997)

Data from the Tri-Counties Regional Cancer Registry study (Section 10.2) included cancers during 1988-1995, within a five-mile radius of SSFL, within Ventura County. Expected numbers were based on average rates for Ventura, Santa Barbara, and San Luis Obispo Counties, then ratioed for population difference. The data for female leukemia was,

Table 1.	1988-1995	Female	0.31 ¹²⁹	Expected 19.4	Observed 6
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Granted that this time period is before Grace was born, but where is the elevated leukemia in this data?

Nevertheless, Melissa was not averse to using her 7-year-old daughter to support her crusade during the February 21, 2017, [DOE Public Meeting on the Draft Environmental Impact Report](#), and is not afraid to express her opinions of DTSC.



Figure 32. Melissa Bumstead

Jared Blumenfeld

One person, who apparently does share Melissa's belief, is one-time CalEPA Secretary, Jared Blumenfeld, with oversight over DTSC. In addition to his public service duties, Mr. Blumenfeld also hosts a podcast, called [Podship Earth](#). [Episode 65](#) of his podcast was devoted to an interview with Melissa, providing her a platform for her story, not that she has ever needed a platform. Jared and Melissa carefully avoided discussing her opinion of DTSC.

After hearing the podcast, I wrote to California Attorney General Bonta expressing concern that a senior State official, with regulatory authority over the cleanup of SSFL, had a conflict of interest, in blatantly displaying a bias that was at odds with his own agency, DTSC's, findings

¹²⁹ No 95% confidence intervals reported



and conclusions.¹³⁰ This complaint did not receive the courtesy of a reply, as is typical of many public officials when they have no good answers to tough questions. However, just one month and four days later, Mr. Blumenfeld resigned as head of CalEPA, and was named to head a new non-profit, climate change funding source, named [Waverly Street Foundation](#).

I am sure that the timing of my complaint and his departure from CalEPA is pure coincidence. But who knows?

18.8.2 Ruth Luevanos

But I digress from the subject of this section, namely the use of children in the dialog on Santa Susana. The following “conversation” is selected not because it is special or unique but because it is typical of the comments made in many public meetings. Perhaps it is special in that it is a local city councilperson who should know better than to mouth off about what she knows little about. But she is a politician, right? OK, I guess I should not have such high expectations! The following could easily have been included in [Section 18.4](#) on politicians.

Ruth Luevanos is a Simi Valley Councilmember who spoke at the June 2, 2022, virtual public meeting on the recently announced DTSC-Boeing Settlement Agreement. The exchange with DTSC Director Meredith Williams can be heard on YouTube.¹³¹ The following is a transcription of Ms. Luevanos’ comments, beginning at 1 hr. 47 min.

Ruth Luevanos: *“Our 127,000 residents are directly impacted by them [Boeing], including myself and **I am a cancer survivor, my daughter has had thyroid issues, dental issues.** We have had **children, residents here that have died of cancer. They've had thyroid issues, dental issues.** I'm also a teacher that lives in the area, in the Los Angeles County part of the area, where I just found out one of my colleagues who's 20 years younger than me, also **has cancer because he lived in West Hills.** So when you talk about risk management, the only risk you're talking about is the risk to Boeing. You're not talking about risk to actual people. Ms. Korenstein's question was the valid one, because I know for a fact that the risk to our city isn't even considered, because it is associated as your legal counsel has associated the risk that the City of Simi Valley, **we're going to be the ones that are sued. Our taxpayers that are getting cancer are going to pay the bill** for Boeing's lack of responsibility, and I want to know why you don't actually care about the risk to actual people and who gave you the authority to give binding arbitration that gets Boeing out of the financial responsibility of **people dying, of***

¹³⁰ Letter from Phil Rutherford to Attorney General Bonta, “Conflict of Interest of CalEPA Secretary Jared Blumenfeld”, July 8, 2022. Available at https://www.philrutherford.com/SSFL/Blumenfeld/Jared_Blumenfeld's_Conflict_of_Interest_2022-07-08.pdf. Accessed October 29, 2022.

¹³¹ YouTube, “Santa Susana Field Laboratory Community Meeting - DTSC/Boeing Settlement Agreement”, June 2, 2022. Available at <https://www.youtube.com/watch?v=ASzB4P6rBOY>. Timestamp 1:47:00 to 1:52:00



children dying of cancer. How can you say that it's based on science to clean up your chemicals because they're going to be closing it for less time? And the **City of Simi Valley is going to be holding the bill** as well as the taxpayers **while we watch our children die?** How can you agree to binding arbitration that removes accountability from the polluter? How can you not think of the risk to us the people? I want to know, I want to know who's going to answer that question?"

Irrelevant comments by Lawrence Hafetz (DTSC attorney) omitted at this point.

Meredith Williams: "Thank you Councilmember Luevanos. You have shared with us in an earlier conversation your experiences with cancer, how closely it's impacted your life, and many other people on this call have had to deal with cancer. And you know, **I do not live in the shadow of this hugely contaminated site, and so I can't pretend to know what that's like to always wonder ...** and the best thing that we can do is to do the cleaning and to do the cleanup that we have to get the cleanup moving forward, and this does that, and the agreement does it, and it does it in a way that is sound, and we're confident that the levels of contaminants that remain in that soil will not be enough to cause health problems, public health problems, environmental problems, stormwater runoff problems, ground problems, groundwater problems. We will hold Boeing accountable."

Ruth Luevanos: "But you understand there's absolutely zero trust, there is zero trust because time and time again, DTSC, Boeing, NASA, and all the players, including the Water Board, Regional Water Board, had betrayed the people that live in this region. There is zero trust and there's no reason to have trust because the risk you manage is that of corporations, and not of the people. So there is zero trust and we're going to fight you tooth and nail, for the full cleanup, the original agreement, to make sure that the **people do not continue to die of cancer.** I'm not going to **have my daughter die of cancer** because you want to limit Boeing's liability when they made \$42 billion in profit last year. They **will not profit off of my cancer, or my daughter's, or anybody else.** I just want to make that clear to you, because you're well aware that this is not done. We are not done, and this is not over."

Meredith Williams: "Thank you, and I'm sure we'll continue to discuss this in the future."

Although this exchange does not mention radiation, one can see that the councilmember was only too willing to use her daughter and children to bolster her rhetoric. Let's look at her words a little more closely.

First, she says her daughter has "thyroid issues." She does not say thyroid cancer and we know that if the daughter did have thyroid cancer then Luevanos would certainly have explicitly said



so. A quick internet search¹³² shows that the most common forms of thyroid disease are hyperthyroidism and hypothyroidism, underactive or overactive production of hormones. Thyroid disease is very common, affecting twenty million people in the US, with women being from 5 to 8 times more likely to be diagnosed than men. My wife had it as a child ... and she lived 7,600 miles from SSFL. Oh, and radiation is not reported to be a risk factor for thyroid disease (as opposed to thyroid cancer).

Second, her daughter has “*dental issues*.” Again, no specifics. Cavities? Orthodontic needs? I think we have all had dental issues and probably the last thing we look to blame is SSFL. I’ll have to check with my Simi Valley dentist on this one. Maybe I should recommend he quits exposing my teeth to radiation every year. Maybe the state can conduct a “*dental issue*” survey of communities surrounding SSFL?

Third, Luevanos doubles down and repeats the “*thyroid issues, dental issues*” for Simi residents in general. She explicitly links these thyroid and dental issues to children and residents dying of cancer.

Fourth, her younger teacher friend “*has cancer because he lived in West Hills.*” Are we supposed to believe in a cause-and-effect relationship. “Has cancer AND he lived in West Hills” is not the same as “*has cancer BECAUSE he lived in West Hills.*” I am sure that Ms. Luevanos knows that “people have cancer AND live everywhere on the planet.”

Fifth, Ms. Luevanos seems to be confused about risk management, accusing DTSC of limiting Boeing’s financial risk against the risk to Simi Valley residents. The EPA risk assessment guidance prescribes the methodology for risk assessment for “reasonably anticipated future land use” for onsite users. This would be recreational, open space use. The Settlement Agreement specifies background for radionuclides and residential land use with 100% consumption of home-grown fruits and vegetables. Both these remediation goals are far stricter than what EPA would impose if SSFL were a Superfund site. Post-remedial soil would be at levels such that Ms. Luevanos and her daughter could live on SSFL property in perfect safety, growing and consuming all their home-grown fruits and vegetables, as long as the mountain lions kept their distance. Obviously Simi Valley residents offsite would be at essentially zero risk from remaining levels of contaminants at SSFL. DTSC’s risk assessment does not include any financial risk accounting for potential future frivolous lawsuits by people like Ms. Luevanos. That would be for the courts to decide.

Sixth, Ms. Luevanos seems to be as much concerned about Simi Valley residents suing the City of Simi Valley as much as the imagined health impacts she is preaching. To make a Trump analogy, that is so easy these days. If politicians lie to their constituents, their constituents will believe the lie and respond accordingly.

¹³² Cleveland Clinic, “Thyroid Disease.” Available at <https://my.clevelandclinic.org/health/diseases/8541-thyroid-disease>. Accessed October 30, 2022.



Sixth, Ms. Luevanos' 4-minute diatribe mentions death and/or cancer 10 times. She mentions her daughter 3 times and children 3 times.

The councilmember's language displays a total lack of understanding of the cleanup process, a total ignorance of the facts presented in this paper and a politician's desire to play to her perceived audience.

Unfortunately, Director Williams' response was not exactly her finest hour ... or should I say one minute and twelve seconds. Williams likely felt the need to empathize with Luevanos. Unfortunately empathy can often be mistaken for agreement. This was especially true in this case when Williams says, *"I do not live in the shadow of this hugely contaminated site, and so I can't pretend to know what that's like to always wonder ..."*

If she had done her homework, she would have known that her own agency, DTSC, has concluded.

- *"Since 1985, multiple chemical and radiological investigations have been conducted at the Santa Susana Field Laboratory (SSFL) and on properties adjoining the site. The investigations included environmental measurements relating to soil, groundwater, surface water, air, and drinking water."*
- *"DTSC has conducted extensive reviews of the offsite environmental data and studies, including data collected by other government agencies."*
- *"To date, DTSC has not found any evidence that contamination from research and testing operations at SSFL has posed or would pose a threat to human health or the environment outside the SSFL site boundaries."*

Director Williams' failure to re-iterate her agency's position lends credence to the rants of people like Luevanos.

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19.0 BEYOND A REASONABLE DOUBT

We are all familiar with conspiracy allegations these days. Conspiracy requires the coordinated actions of large number of people and organizations to conduct nefarious acts, intentionally hide the truth, misinform and disinform. Conspiracies are very hard to keep hidden since nobody likes to keep secrets for long periods of time.

A very large number of people, organizations and agencies have consistently maintained that SSFL has not contaminated the surrounding communities and that people are not contracting cancer as a result of hypothetical exposures to non-existent radionuclide and chemical contamination. Direct quotes of study conclusions have been highlighted in yellow in the preceding pages. It is not credible that all these people from diverse and separate organizations are conspiring to lie to the community. The following tables cover offsite sampling, community exposure studies, community cancer registry studies, wildfires, offsite waste disposal and worker health studies. The tables identify the number of agencies/organizations/individuals concluding that SSFL has had NO offsite impact, and the small number of individuals alleging an offsite impact.

In Tables 10, 11, 12 and 13, the “no offsite impact” list is comprised of professional environmental scientists, health physicists, federal and state agencies, and public health experts. The “alleged offsite impact” list is full of anti-nuclear activists, manipulated politicians, yellow journalists, and sadly misinformed public.

Similarly, in Table 14, comparisons of worker health studies show a majority of experts supporting NO impact on worker health.

Recalling the earlier discussion in [Section 10.0](#) about the two standards of burden of proof, it is clear that, not only is there an overwhelming “preponderance of evidence”, but it is also “beyond a reasonable doubt” that SSFL has NOT had an offsite impact on neighboring communities.



Table 10. Evidence from Offsite Sampling

Location	No Offsite Impact	Alleged Offsite Impact
Ahmanson Ranch	<ul style="list-style-type: none">DTSCDHS	<ul style="list-style-type: none">Dan HirschSheila KuehlBarbara BoxerDiane FeinsteinElton GalleglyNBC Channel 4Physicians for Social ResponsibilitySouthern California Federation of ScientistsMichael CollinsCommunity Residents
American Jewish University	<ul style="list-style-type: none">DTSCTetra TechJoel CehnGSI Environmental	
Bell Canyon	<ul style="list-style-type: none">DTSCOgden Environmental	
Brandeis-Bardin Institute/Sage Ranch	<ul style="list-style-type: none">DTSCEPA	
Chatsworth Reservoir	<ul style="list-style-type: none">DTSCEssentia Mgmt. Services	
Dayton Canyon	<ul style="list-style-type: none">DTSCDHSAllwest RemediationAuxier AssociatesCabrera Services	
Orcutt Ranch	<ul style="list-style-type: none">DTSC	
Rocketdyne Recreation Facility	<ul style="list-style-type: none">DTSCLawrence Livermore National Laboratory	
Runkle Canyon	<ul style="list-style-type: none">DTSCDHSDade Moeller & Associates	
Woolsey Canyon	<ul style="list-style-type: none">DTSCDPH	



Table 11. Evidence from Community Health Studies

Topic	No Offsite Impact	Alleged Offsite Impact
Community Cancer Studies	<ul style="list-style-type: none">• DHS• DTSC• DTSC Advisory Panel• Tri-Counties Regional Cancer Registry• Public Health Institute• Dr. Thomas Mack• Dr. Allan Warren• Dr. William Blot	<ul style="list-style-type: none">• Dr. Hal Morgenstern• Dr. Yorum Cohen• Dan Hirsch's Advisory Panel
Community Exposure Studies	<ul style="list-style-type: none">• ATSDR• Health Physics Society• Dr. Allan Warren• Dr. John Frazier• John Krsul• Groundwater Panel• Dr. Jerry Christian• John Daniel	

Table 12. Evidence from the Woolsey Fire

Topic	No Offsite Impact	Alleged Offsite Impact
Woolsey Fire	<ul style="list-style-type: none">• California Environmental Protection Agency (CalEPA)• Department of Toxic Substances Control• Office of Environmental Health Hazard Assessment• California Department of Public Health• U.S. Environmental Protection Agency• USDOE, National Nuclear Security Administration (NNSA), Office of Nuclear Incident Response• USDOE NNSA Consequence Management Home Team• Department of Energy• DOE Rapid Assessment Unit from Lawrence Livermore National Laboratory• California National Guard, 9th Civil Support Team• LA County Department of Public Health, Radiation Management• Los Angeles County Regional Water Quality Control Board• Risk Assessment Corporation	<ul style="list-style-type: none">• M. Kaltofen• M. Gunderson• A. Gundersen



Table 13. Evidence from Offsite Disposal of Decommissioned Material

Topic	No Offsite Impact	Alleged Offsite Impact
Offsite Disposal of Waste and Decommissioned Material	<ul style="list-style-type: none">• DHS/RHB• DPH/RHB• DOE• ORISE• ORAU• ANL• NRC• EPA• DTSC• Clean Harbors• Waste Management• LA County of Health Services (Radiation Management)• Groundwater Resources Consultants• GeoChem Applications	<ul style="list-style-type: none">• Sheila Kuehl• Barbara Boxer• Dan Hirsch• LA City Council

Table 14. Evidence from Worker Health Studies

Topic	No Worker Impact	Alleged Worker Impact
Worker Health Studies	<ul style="list-style-type: none">• Dr. John Boice• Dr. William Blot• International Epidemiology Institute• Oak Ridge Associated Universities• Oak Ridge National Laboratory• IEI Science Committee• Dr. Otto Raabe• Dr. Myron Pollycove• Charles Willis• Michael Ford• Robert Holloway• Peter Bond• Roger Grimson	<ul style="list-style-type: none">• Dr. Hal Morgenstern• Dr. Beate Ritz• Dan Hirsch's Advisory Panel



ABOUT THE AUTHOR

Phil Rutherford has a B.A. in Physics, and an M.A. from Trinity College, University of Oxford. He has an M.Sc. in Reactor Physics & Technology (Nuclear Engineering) from the University of Birmingham (UK).

Phil has fifty one years of experience in the nuclear industry, with leadership and management responsibility for nuclear plant reliability, safety analysis and probabilistic risk assessment for LWRs, LMFBRs and nuclear space power systems, health physics, radiation safety, radiological risk assessment, nuclear decommissioning, radiation worker epidemiology studies, community cancer studies, legislative affairs, litigation, waste management & disposal, interpretation of radiological data for soil, groundwater, surface water and air, community relations, media relations, records management, health & safety, DOE compensation programs, historical site assessments, and space nuclear safety.

While at Rockwell International (18 years) and The Boeing Company (19 years), he held the following management positions,

- Manager of Nuclear Safety & Reliability Engineering
- Manager of Radiation Protection & Health Physics Services
- Senior Manager of Environmental Remediation
- Senior Manager of Radiation Safety
- Senior Manager of Health, Safety & Radiation Services

From 1990 till his retirement in 2015, Phil was responsible for radiation safety at the Santa Susana Field Laboratory (SSFL), including the Department of Energy's radiological monitoring, remediation, and nuclear decommissioning at the Energy Technology Engineering Center.

Currently, he is President of [Phil Rutherford Consulting](http://www.philrutherford.com), providing consulting services and online resources in radiation safety, environmental radiological risk assessment and nuclear decommissioning.



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