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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 9
75 Hawthorne Street
San Francisco, CA 94105-3901

November 30, 2001

MEMORANDUM

SUBJECT: Transmittal of Perchlorate Maps and Table, Updated November, 2001

FROM: Kevin P. Mayer, SFD-7-2 Kevin P. Mayer

TO: Annie Jarabek, NCEA

This memo transmits November, 2001, updates of the Perchlorate table and maps produced by EPA Region 9's GIS Center. The previous versions and transmittal memo were dated September 25, 2001. A third map depicting detections of perchlorate in California public water supply sources is also transmitted, updated with data available in October, 2001. The table is entitled "Occurrence and Potential Sources of Perchlorate Releases to the Environment as of November, 2001". This version includes two facilities which were not included in the September, 2001, table which have subsequently been confirmed by Region 7 and 10 officials. The map which shows Reported Perchlorate Releases in the United States displays the locations of the facilities listed in the table. All locations on the Releases map are also depicted on the second map: Manufacturers and Users in the United States. The second map includes other locations of manufacturers and users of perchlorate identified by a number of information sources. The 57 locations with reported environmental releases of perchlorate are in 20 different states. The 223 locations of manufacturers and users of perchlorate are in 40 different states. No users or releases have been identified in Hawaii or Alaska, although these states are now depicted on the map of the United States.

Information on Manufacturers and Users

The primary sources for the Manufacturers and Users map are responses to information requests from Kerr-McGee Corporation (responses dated April 17, 1999 and March 7, 2001) and American Pacific Corporation (response dated April 14, 1998). EPA Region 9 had requested the names of customers of these two perchlorate manufacturers to whom shipments of at least 500 pounds in any one year had been made. The Department of Defense has provided some information on facilities using perchlorate. A more thorough survey of perchlorate use at DoD facilities has been undertaken but was not completed by the time of this update. Other information sources include monographs on the perchlorate manufacturing industry.

Information on Perchlorate Releases

The table and map of reported perchlorate releases to the environment was an effort by a multi-region U.S. Environmental Protection Agency committee to bring together the available information on where this chemical has been detected in the environment nationwide . The investigations that are the source of the data represent diligent and often ground-breaking efforts of state and local authorities as well as that of EPA offices.

Because the information was gathered for various purposes and with different and sometimes unspecified protocols, it is essential to explicitly explain what these data do and do not represent.

An Ongoing Effort to Communicate Information To-Date

We felt that the process of communication was important even if our information was incomplete or imperfect. We deliberately intended this document to spur corrections, additions or deletions of the information contained in the table. There has been no standardized approach to collecting or reporting perchlorate data nationwide.

We did intend to raise awareness that this hitherto unrecognized chemical is being found in water systems in nearly every type of climatic regime in the US. In some instances, perchlorate was unexpectedly detected in areas where no obvious perchlorate handling activities took place. In most others, perchlorate was found in the environment near facilities that were documented users or manufacturers of perchlorate salts.

Standards for Reporting Perchlorate Releases

We attempted to apply reasonable judgement in identifying "confirmed" releases and even in identifying "unconfirmed releases". In California, public water supply wells must have detectable levels of perchlorate in at least two sampling periods before being considered actually detected. Most of the sites we listed from California and other states meet this criterion. At sites with many sampling points, multiple detections provided a preponderance of evidence that a perchlorate release had occurred. We omitted several sites where perchlorate was detected once but not in subsequent sampling events. We also omitted sites where perchlorate detections have not been corroborated to the satisfaction of regional officials. The American Water Works Service Company published a report (Siddiqui et al., 1998) identifying wells in their systems nationwide with perchlorate detections, and we included these locations even though we could not consider them confirmed. Resampling by AWWSC failed to detect perchlorate in a number of these wells. EPA Region 3 investigated the Yardley, PA, report from AWWSC but could not detect perchlorate in nearby groundwater. We felt it important to recognize this report but to note the lack of independent corroboration.

Perchlorate in soil posed another set of difficulties in reporting a site as having a confirmed release. Without a standardized sampling and analytical protocol, quantification of soil concentrations could be misleading and were omitted from the table. The solubility of perchlorate salts is so great that perchlorate-containing material found uncontained on the soil surface might reasonable be assumed to be contributing perchlorate to the subsurface through inevitable dissolution. We do have a number of sites where the association between soil

contamination and groundwater contamination is strongly established. There are also sites where no water samples have yet been analyzed even though perchlorate has been detected in surface soils. The distribution of a solid perchlorate-bearing material on the soil surface may not be uniform. In one instance, identifiable pieces of a perchlorate-bearing propellant were gathered from the soil surface and this location is reported as a confirmed release.

Some Acknowledged Limitations

Obviously, few details or clarifying information can be contained in a single table much less in a single number. The table provides only a single maximum concentration value for any site. It is very possible that the information may not provide an accurate picture of any particular site. At some sites, samples have been collected for over three years at literally hundreds of monitoring points with fastidiously documented quality control. At others we have only a single monitoring point with perhaps only two water samples analyzed for perchlorate and no statistical evaluation is possible. The maximum value is not necessarily representative of the nature and extent of the perchlorate release for the site, and the maximum value may be much higher than any other value at that location.

Although many of the data originated from site-specific investigations, this document does not presume to definitively identify the facility responsible for the release nor the type of operation associated with the release. Some of the facilities are fairly isolated and have clear histories of perchlorate handling. Others facilities mentioned are reasonable possibilities based on current information. There are a few with completely unidentified sources - occasionally with several potential contributors.

Difference in Search Effort Throughout the United States

It is important to realize that the lack of perchlorate releases in a particular state or locality may merely reflect the absence of an effort to search for this contaminant. Neither the table nor the map indicates the extent of the investigation activities where perchlorate was not detected. Widespread monitoring efforts occurred in only a handful of states by the year 2001: Arizona, California, Iowa, Nebraska, New Mexico, New York (Suffolk County), Texas and Utah. Few perchlorate investigations have occurred in the eastern United States. Notable exceptions are at specific facilities in West Virginia, Maryland and the follow-up investigation in Pennsylvania. At the current state of knowledge, the distribution of perchlorate detections in the environment seems to be directly related to the effort put forth in searching for perchlorate.

A high proportion of the locations on the current list of reported perchlorate releases were specifically targeted for perchlorate testing. At a number of sites, State or federal cleanup activities were ongoing before perchlorate was identified as an environmental issue.

A few of the localized efforts to search for perchlorate should be noted. California added perchlorate to the list of unregulated monitoring requirements in 1999 and California Department of Health Services officials have reported results from testing over 3,300 public water supply

sources in addition to more than a thousand monitoring wells tested around the state. In eastern Long Island, more than 500 wells - public, residential and monitoring wells - have been tested throughout Suffolk County. Utah tests approximately 60 pubic water supply wells in areas that may be affected by perchlorate handling facilities. Arizona officials have tested for perchlorate in water supply samples collected throughout the state and are involved in investigations at several facilities that have the potential for perchlorate releases. Several states are working with EPA's Region 7 to test rural wells for agricultural chemicals and added perchlorate as an analyte in approximately 30 locations in Nebraska and nearly 100 locations in Iowa. Texas and New Mexico officials are aggressively investigating for perchlorate at many likely sources, even beyond those facilities identified by perchlorate manufacturers and the Defense Department.

TABLE 1. OCCURRENCE AND POTENTIAL SOURCES OF PERCHLORATE RELEASES TO THE ENVIRONMENT as of NOVEMBER, 2001. [a]

State	Location	Suspected Source	Type of Contamination	Max. Conc. ppb
AL	Redstone Army Arsenal - NASA Marshall Space Flight Center Huntsville, AL	Propellant Manufacturing, Testing, Research, Disposal	Monitoring Well Springs/Seeps	19,000 37
AZ	Apache Nitrogen Products Benson, AZ	Explosives Manufacturing	Monitoring Well	670
AZ	Aerodyne Gila River Ind. Res., Chandler, AZ	Propellant Testing	Monitoring Well	18
AZ	Davis Monthan AFB Tucson, AZ	Explosives/ Propellant Disposal	Soil	Not Confirmed
AZ	Unidynamics Phoenix Inc. Phoenix Goodyear Airport Goodyear, AZ	Explosives/Ordnance Manufacturing	Monitoring Well	80
AZ	Universal Propulsion Phoenix, AZ	Rocket Manufacturing	Soil	--
AZ	Unidynamics Phoenix Inc. White Tanks Disposal Area Maricopa County, AZ	Explosives/ Ordnance Disposal	Public Water Supply Well (Unconfirmed Report) Soil	(4) --
AR	Atlantic Research East Camden, AR	Rocket Manufacturing Disposal - Open burn/ Open detonation	Monitoring Well Surface Water Soil	1,500 480,000 --
CA	Aerojet General also affects Mather AFB Rancho Cordova, CA	Rocket Manufacturing	Public Water Supply Well Monitoring Well	260 640,000
CA	Alpha Explosives Lincoln, CA	Explosives Manufacturing	Monitoring Well Reported in Surface Water	67,000
CA	Boeing/ Rocketdyne, NASA at Santa Susana Field Lab USDOE Santa Susana, CA	Rocket Research, Testing and Production	Monitoring Well	750
CA	Edwards AFB Jet Propulsion Lab, North Base Edwards, CA	Rocket Research	Monitoring Well	300
CA	El Toro Marine Corps Air Station Orange Co., CA	Explosives Disposal	Monitoring Well	380
CA	Lawrence Livermore National Laboratory Site 300 Tracy, CA	U.S. Dept. of Energy Explosives Research	Monitoring Well	84
CA	Lockheed Propulsion Upper Santa Ana Valley Redlands, CA	Rocket Manufacturing	Public Water Supply Well	87

(a) - Information from Mayer (2001). All reports have been confirmed by federal, state or county agencies except where noted. Soil concentrations are not listed.

TABLE 1.(continued) OCCURRENCE AND POTENTIAL SOURCES OF PERCHLORATE RELEASES TO THE ENVIRONMENT as of NOVEMBER, 2001. [a]

State	Location	Suspected Source	Type of Contamination	Max. Conc ppb
CA	NASA - Jet Propulsion Lab Raymond Basin Pasadena, CA	Rocket Research	Public Water Supply Well	54
CA	Rialto, CA	Fireworks Facility (?) B.F. Goodrich(?) Rocket Research and Manufacturing	Public Water Supply Well (inactive)	811
CA	San Fernando Valley Glendale, CA	Grand Central Rocket (?) Rocket Manufacturing	Monitoring Well	84
CA	San Gabriel Valley Baldwin Park, CA	Aerojet Rocket Manufacturing	Public Water Supply Well Monitoring Well	159 2,180
CA	San Nicholas Island Ventura Co., CA	U.S. Navy Firing Range	Public Water Supply (Springs)	12
CA	Stringfellow Superfund Site Glen Avon, CA	Hazardous Waste Disposal Facility	Monitoring Well Private Well	682,000 37
CA	UTC (United Technologies) San Jose, CA	Rocket Testing	Monitoring Well	180,000
CA	Whittaker-Bermite Ordnance Santa Clarita, CA	Ordnance Manufacturing	Public Water Supply Well	47
CA	Whittaker Ordinance Hollister, CA	Ordnance Manufacturing	Private Well Monitoring Well	810 88
IN	American Water Works Service Greenwood, IN	Unknown source	Public Water Supply Well (Unconfirmed Report)	(4)
IA	American Water Works Service Clinton. IA	Unknown source	Public Water Supply Well (Unconfirmed Report)	(6)
IA	Ewart, IA	Unknown source	Livestock Well	29
IA	Hills, IA	Unknown source	Private Well	30
IA	Iowa Army Ammunition Plant Middleton, IA	Propellant handling	Monitoring Well	9
IA	Napier, IA	Agriculture(?)	Private Well	11
KS	Herington, KS	Ammunition Facility	Monitoring Well	9
MA	Massachusetts Military Res. Barnstable Co., MA	Disposal - Open burn/ Open detonation	Monitoring Well	300
MD	Naval Surface Warfare Center Indian Head, MD	Propellant Handling	Waste Discharge to Surface Water	>1,000
MD	White Oak Fed. Research Center (Naval Surface Warfare Center) White Oak, MD	Propellant Handling	Monitoring Well	72

(a) - Information from Mayer (2001). All reports have been confirmed by federal, state or county agencies except where noted. Soil concentrations are not listed.

TABLE 1.(continued) OCCURRENCE AND POTENTIAL SOURCES OF PERCHLORATE RELEASES TO THE ENVIRONMENT as of NOVEMBER, 2001. [a]

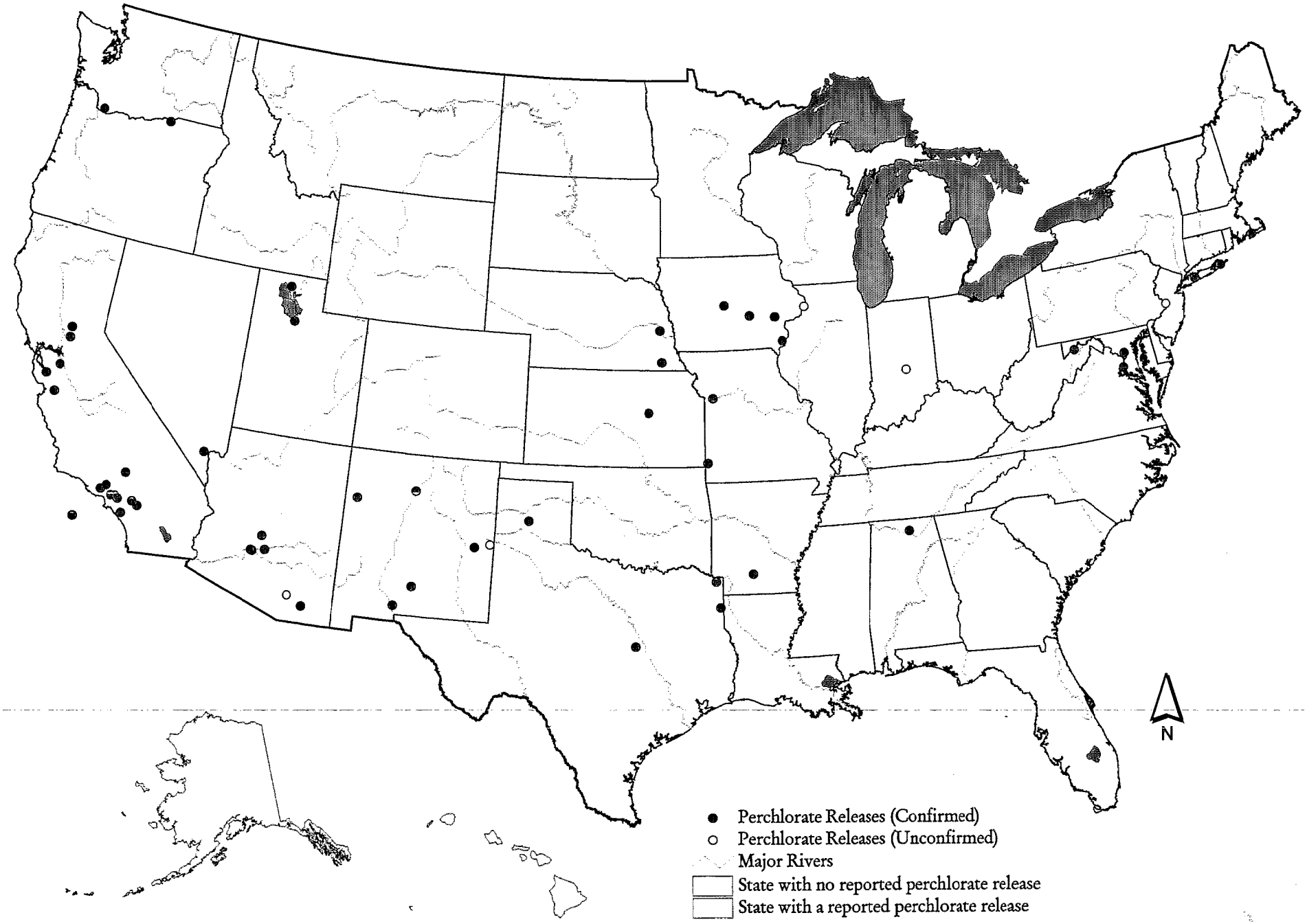
State	Location	Suspected Source	Type of Contamination	Max. Conc. ppb
MO	ICI Explosives Joplin, MO	Explosives Facility	Monitoring Well	107,000
MO	Lake City Army Amm. Plant Independence, MO	Propellant Handling	Monitoring Well	70
NE	Lewiston, NE	Agricultural Chemical Facility	Shallow Private Well	5
NE	Mead, NE	Fireworks Facility	Monitoring Well	24
NV	Kerr-McGee/BMI Henderson, NV	Chemical Manufacturing	Public Water Supply Monitoring Well Surface Water	24 3,700,000 120,000
NV	PEPCON Henderson, NV	Chemical Manufacturing	Monitoring Well	600,000
NM	American Water Works Service Clovis, NM	Unknown	Public Water Supply Well (Unconfirmed Report)	(4)
NM	Fort Wingate Depot Activity Gallup, NM	Explosives Disposal	Monitoring Well	2,860
NM	Holloman AFB Alamogordo, NM	Rocket Testing	Monitoring Well Seasonal Surface Water Soil	40 16,000 --
NM	Los Alamos National Lab Los Alamos, NM	U.S. Dept of Energy Lab Chemicals	Public Water Supply Well Monitoring Well Deep Borehole Water	3 220 1,662
NM	Melrose Air Force Range Melrose, NM	Explosives	Public Water Supply Well	25
NM	White Sands Missile Range White Sands, NM	Rocket Testing	Monitoring Well Soil	21,000 --
NY	Westhampton Suffolk County, NY	Unknown Source(s), Possibly Agricultural	Public Water Supply Well Monitoring Well	16 3,370
NY	Yaphank Suffolk County, NY	Fireworks	Private Well Monitoring Well	26 122
OR	Umatilla Ammunition Demolition Area Hermiston, OR	Disposal	Monitoring Well	10
PA	American Water Works Service Yardley, PA	Unknown	Public Water Supply Well (Unconfirmed Report)	(5)

(a) - Information from Mayer (2001). All reports have been confirmed by federal, state or county agencies except where noted. Soil concentrations are not listed.

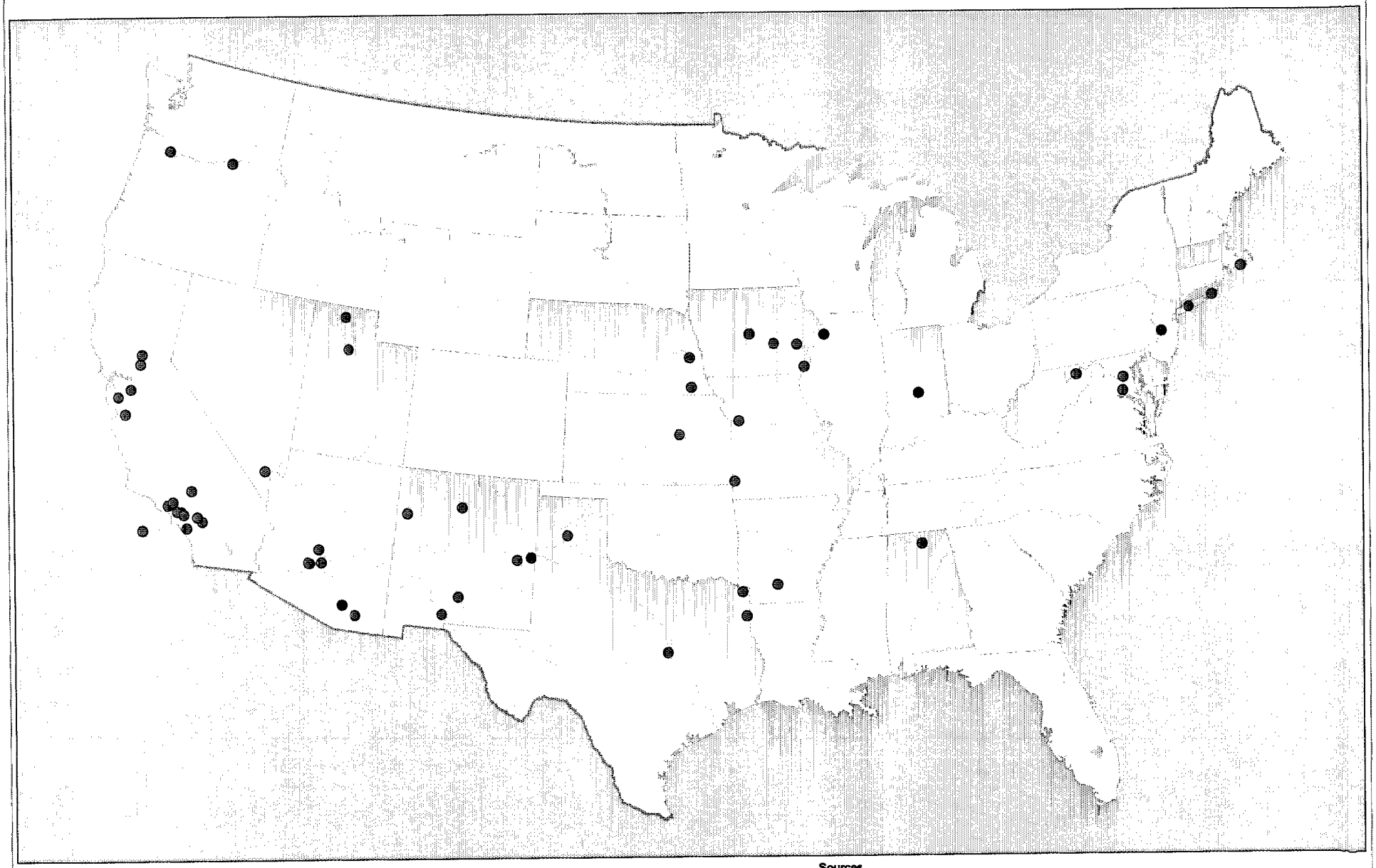
TABLE 1.(continued) OCCURRENCE AND POTENTIAL SOURCES OF PERCHLORATE RELEASES TO THE ENVIRONMENT as of NOVEMBER, 2001. [a]

State	Location	Suspected Source	Type of Contamination	Max. Conc. ppb
TX	Longhorn Army Ammunition Depot Karnak, TX	Propellant Handling	Monitoring Well Reported in Surface Water Soil	169,000 -- --
TX	McGregor Naval Weapons Plant McGregor, TX	Propellant Handling	Monitoring Well Reported in Surface Water Soil	91,000 -- --
TX	PANTEX Plant (USDOE) Amarillo, TX	Explosives	Monitoring Well	5
TX	Red River Army Depot Texarkana, TX	Propellant Handling	Monitoring Well	80
UT	Alliant Tech Systems Magna, UT	Rocket Manufacturing	Public Water Supply Well	16
UT	Thiokol Promontory, UT	Rocket Manufacturing	Water Supply Well (Inactive)	42
WA	Camp Bonneville near Vancouver, WA	Explosives/Propellant Disposal	Soil	--
WV	Allegheny Ballistics Lab Rocket Center, WV	Rocket Research, Production, Open burn /Open detonation	Surface Discharge of Groundwater Extraction	400

(a) - Information from Mayer (2001). All reports have been confirmed by federal, state or county agencies except where noted. Soil concentrations are not listed.


N
Perchlorate Releases (Confirmed)
Perchlorate Releases (Unconfirmed)
Major Rivers
State with no reported perchlorate release
State with a reported perchlorate release

U.S. Perchlorate Releases



- Confirmed Sites
- Unconfirmed Sites
- Major Rivers
- Affected States

N

Scale: 1:20,000,000

200 0 200 400 Miles

Sources

1. USEPA Regions 1, 3, 4, 6, 7, 9, 10
2. California Department of Health Services
3. Arizona Department of Environmental Quality
4. New Mexico Environmental Department
5. Texas Natural Resource Conservation Commision
6. Utah Department of Environmental Quality
7. West Virginia Division of Environmental Protection
8. Suffolk County, New York, Department of Health Services
9. Siddiqui et. al. 1998

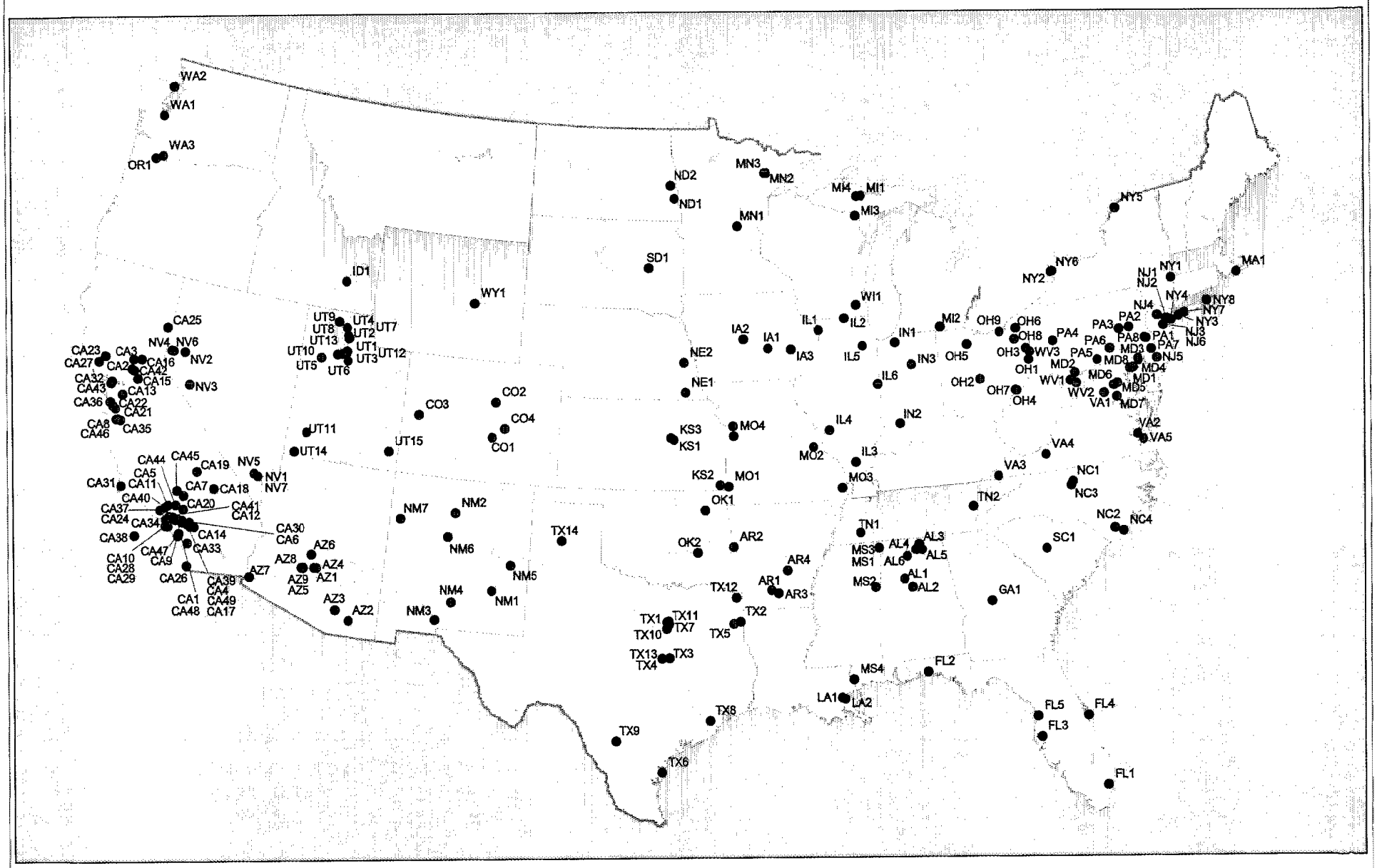
EPA

Region 9 GIS Center

October 12, 2001

N
Perchlorate Manufacturers and Users
Major Rivers
State does not contain a known manufacturer or user
State contains a known manufacturer or user

U.S. Perchlorate Manufacturers and Users



● Perchlorate Sites
Major Rivers
Affected States

N

Scale: 1:20,000,000

200 0 200 400 Miles

Sources

1. Kerr-McGee's 104(e) Response, 1996 and 2001
2. Department of Defense Information Request, 1996
3. American Pacific Non-CBI 104(e) response, 1996
4. Letter from J.V. Lovell regarding PEPCON litigation, August 17, 1990
5. USEPA Regions 1, 3, 4, 6, 7, 9, 10
6. California Department of Health Services
7. Arizona Department of Environmental Quality
8. New Mexico Environmental Department
9. Texas Natural Resources Conservation Commission
10. Utah Department of Environmental Quality
11. West Virginia Division of Environmental Protection
12. Suffolk County, New York Department of Health Services, 2001
13. Siddiqui et. al., 1996
14. US Department of Energy
15. Schumacher, 1990

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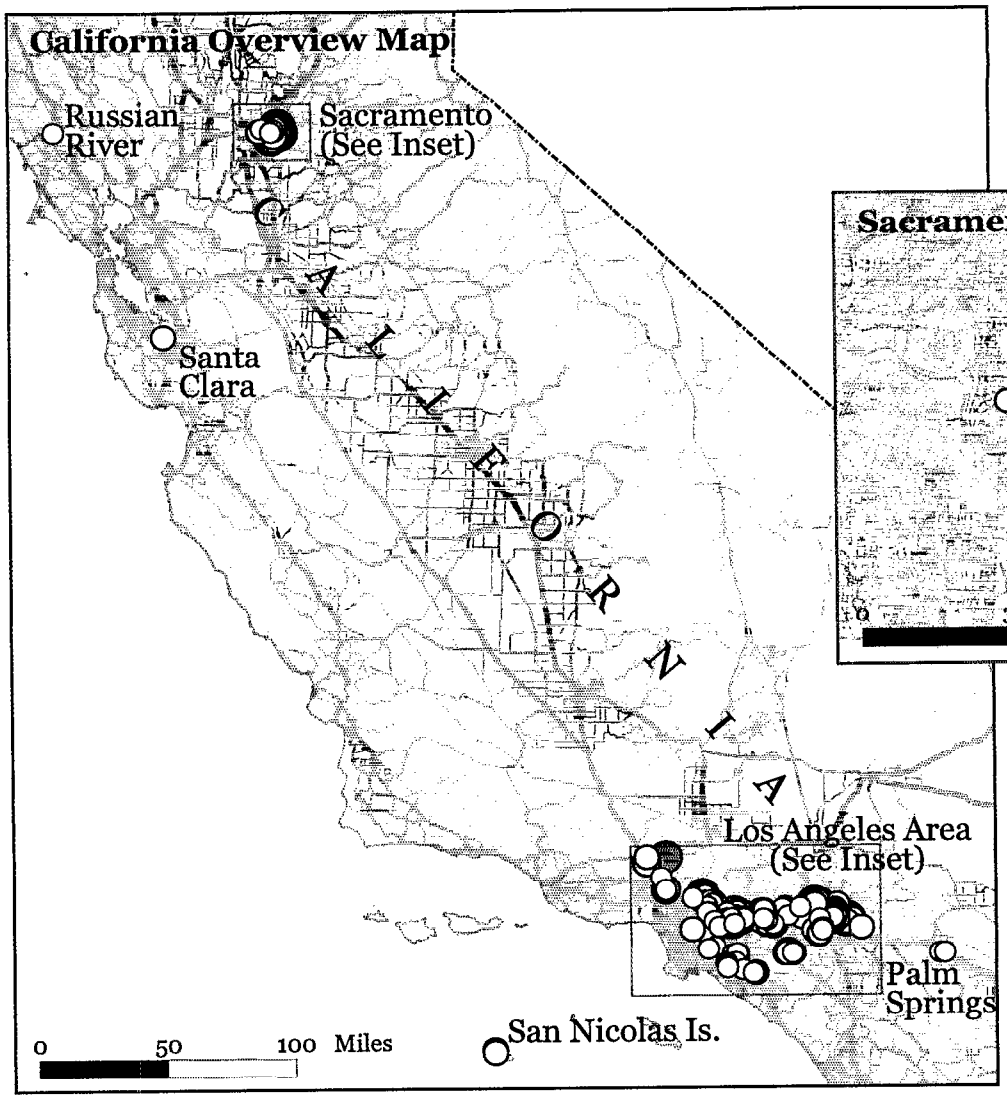
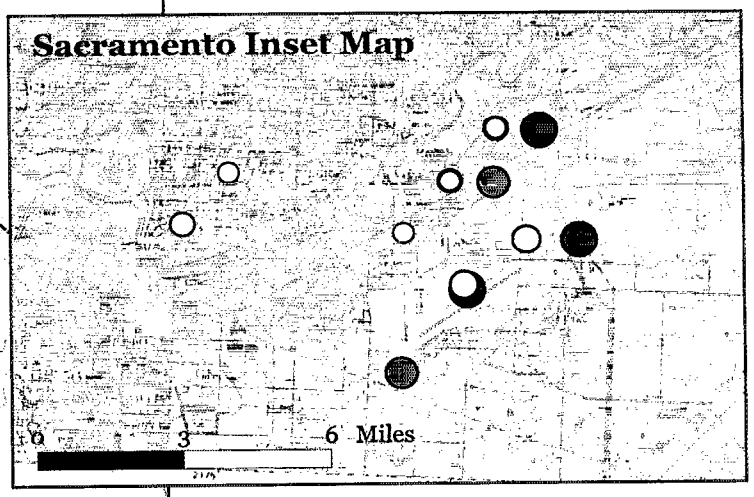
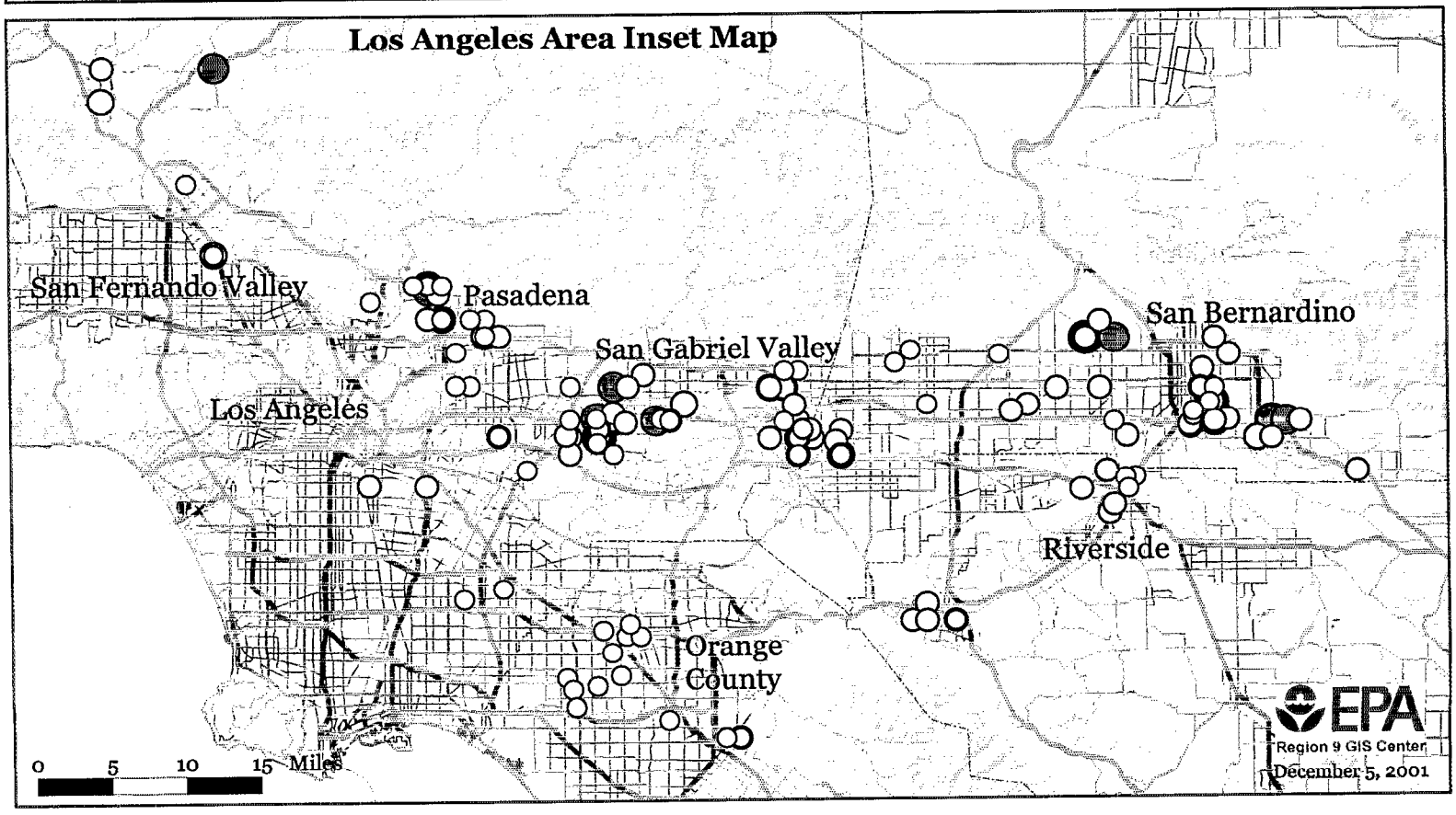
California Perchlorate Detections in Drinking Water Sources





Source of well locations and perchlorate values: California Department of Health Services

- 4-9 µg/L
- 9 - 17.9 µg/L
- 18 - 31.9 µg/L
- 32 - 100 µg/L
- > 100 µg/L