

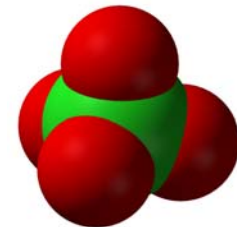
# Department of Defense 2009 Update on Perchlorate

## - Facts & Myths -



# Perchlorate - Background

- A salt...1 chlorine + 4 oxygen atoms ...Highly soluble in water...can inhibit normal thyroid function at certain levels...pregnant women/fetuses especially sensitive
- Potassium or ammonium perchlorate is used as an oxidizer in some missiles, rockets, munitions due to its powerful and insensitive nature (DoD/NASA)
- Also used in fireworks, explosives, road flares, matches, dyes, paint, air bags, recyclable batteries
- Found in some fertilizers, degradation of household bleach products, water disinfection products, herbicides and other products with chlorine or perchloric acid
- Found naturally – in arid parts of the world



# Evolving Perchlorate Science

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- **2005 NAS<sup>1</sup> Peer Review of science**
  - Recommended RfD of 0.0007 mg/kg/day
- **2006 CDC<sup>2</sup> studies (more ongoing)**
- **2007 FDA<sup>3</sup> “Market Basket” Total Diet Study**
  - Various foods (e.g., lettuce, tomatoes, milk) tested for perchlorate
  - Perchlorate intake from food is below the current RfD for even sensitive subpopulations
- **State/Federal/Academic Studies**
  - Numerous sources, including natural, likely contributors to exposure
  - Isotopic analysis now allows distinguishing between natural and man-made sources...more details later in brief
- **EPA IG Report – Dec 2008**
- **EPA Request for More Information for Regulatory Determination Analysis – Aug 2009**

<sup>1</sup> NAS = National Academy of Sciences    <sup>2</sup> CDC = Center for Disease Control    <sup>3</sup> Food & Drug Administration

# DoD Risk Management Strategy

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- **DoD Policies & Sampling/Characterization – Find the releases**
  - DoD Sampling began ~15 years ago
  - DoD 2006 sampling policy memo required sampling in all media (ranges covered by DoDI)
  - California site prioritization protocol completed
  - DoD 2009 policy uses new EPA recommended Preliminary Remediation Goal (PRG); supersedes previous policy memos and says use EPA RfD
- **Response via DERP<sup>1</sup> – Address the releases**
  - Lack of MCL *does not stop* response actions
  - RfD used for site-specific risk assessments
- **Invest in R&D – Determine sources & substitutes**
  - Over \$114M invested in perchlorate substitutes,
  - Sampling & analytical methods, and
  - Treatment technologies

<sup>1</sup> Defense Environmental Restoration Program

# DoD-Wide Perchlorate Sampling Results

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- **Over 300 installations/FUDS sampled to date**
  - Represents all potential sources of releases in all media
  - Over 52,000 samples ...vast majority below 4 ppb
    - Installation summaries on line for public access; Annually updated
- **All sites with possible perchlorate releases have appropriate actions\* underway or completed in consultation with regulators**

\* Actions underway include any or all of: initial sampling, continuous monitoring, risk assessments, consultation with regulators, & remedial actions

# California Prioritization Protocol Results

## - A Success Story-

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- **DoD & CAL agreed on protocol to screen DoD sites for risk to ground/surface drinking water**
- **Total of 924 possible sites jointly screened**
  - Details on next slide
- **DoD & CAL met in March 2008 to review results**
  - CAL-DTSC and WQCB agree that no sites currently pose a threat to drinking water
  - Appropriate actions being taken regarding releases -  
Mostly confined to DoD properties
- **DoD and CAL authored article in *Environmental Management* journal describing success of program**

# State/Local Findings

- 2005 State of Massachusetts letter to EPA Assistant Administrator, Mr. Robert Golledge, Commissioner, Massachusetts Department of Environmental Protection stated
  - *“...When confronted with the perchlorate plume at Massachusetts Military Reservation in 2001, most thought the primary source of perchlorate contamination was the result of military training activities. None of the nine water supplies that have tested positive for perchlorate in Massachusetts appear to have any connection to military bases or activities.”* 3/14/2005 letter from Mr. Robert Golledge, Commissioner, Massachusetts Department of Environmental Protection stated
- 2007 East Valley Water District, Highland, CA Testimony:
  - *“Based upon research conducted by our regional water quality control board (Santa Ana Region), we have concluded that our perchlorate problem can be traced back to fertilizer brought in from South America in the early 20th century and used on orange groves that are now part of our service area.”* April 10, 2007 Calif House NRC/W&P hearing
- EPA Region III study of Potomac River (study still underway)
  - Very low detections (not a concern) - no evidence to suggest DoD sources

# So What Are the Potential Sources of Exposure?

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- **Road Flares**

- 20-40 million flares sold annually; 5-6% potassium perchlorate in unburned flares
- Max concentration leaving highway 314,000 ppb (measured)

- **Fireworks**

- Over **200 M lbs.** consumed in U.S. per year...90% imported
- Fireworks contain up to 70% potassium perchlorate
- Field sampling...Pre-fireworks at non-detect...Post fireworks up to 5000 ppb



- **Fertilizers**

- >100 million lbs. Chilean fertilizer applied in the U.S.; High in perchlorate...100,000 ppb
- > 400,000 lbs. per year still being applied (e.g., organic farming)

- **Defoilants/Weed Killers**

- By product - 17,000-22,000 ppb

- **Household Bleach & Drinking Water Treatments**

- Increases with age and with exposure to sunlight

- **Natural Sources**

- Arid southwest US

- **Ozone**

- Uptake by plants theorized as a mechanism by which perchlorate is found in plants; initial studies  $O_3$  nonattainment areas have plants with higher perchlorate





# Comparison of DoD Perchlorate Use to Fireworks Use

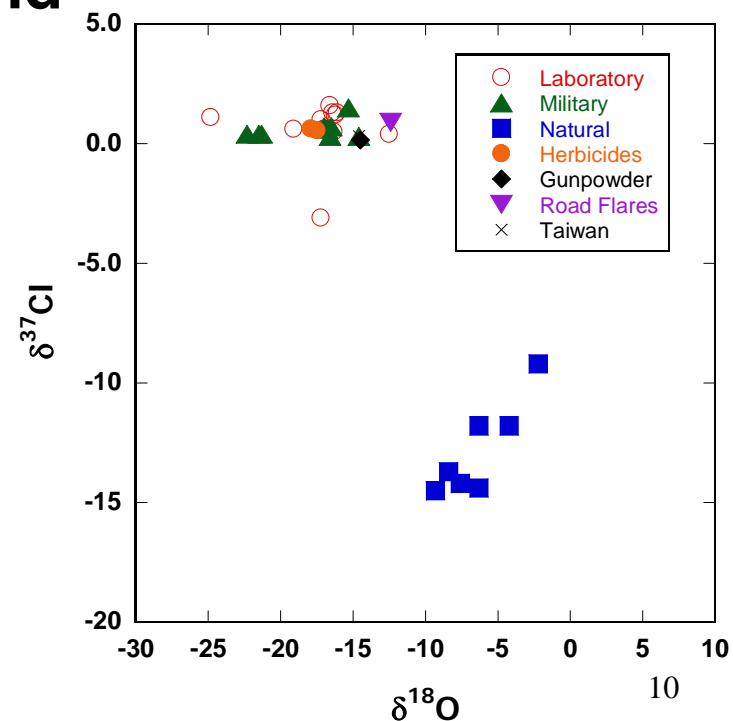
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- **Fireworks**
  - **278.2 M lbs of fireworks were consumed** in the U.S. annually over the last 5 years (per American Pyrotechnics Association)
    - ~ **14 M pounds** of which is perchlorate
    - Used largely uncontrolled over large areas
    - Imports increasing
- **DoD**
  - Perchlorate-containing munitions items used in training represent an annual expenditure of nearly **1.6M lbs** of perchlorate compounds – confined to specific range areas.
  - DoD purchased of perchlorate compounds in weapon systems was between **6 - 8 M lbs/yr** over the last five years.
  - Previous purchases: ~ **4 M lbs/yr** of ammonium perchlorate is recovered as part of the Strategic Programs Office Minuteman program and is sent back to the manufacturer who then uses it in commercial applications such as blasting agents or perchloric acid.

# Techniques now Available to Distinguish Natural from Manmade Sources: Isotopic Analysis

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- Elements in a compound can have widely different isotopic ratios or atomic mass based on mode of formation
- Stable isotope ratios provide a unique “fingerprint” of a chemical compound
- Future research shows promise for distinguishing among different manufactured sources



# DoD Perchlorate Treatment RDT&E

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- **Southern California Drinking Water Treatment Activities**
  - FY05-09 Congressional adds to DoD budget = \$22.6M
  - 6 technologies competitively selected and deployed
    - Demonstrations under way in Rialto, Colton, Fontana, West Valley and East Valley
    - Water purveyors and CALDHS involved
    - Approximately 5000 gpm new treatment capacity in Inland Empire region
  - Additional full scale systems in development
  - Significant cost reductions
    - Projected 25% capital cost reductions
    - Projected O&M cost reductions of 40% to 60%
- **Sites have no linkage to DoD release of perchlorate**

# DoD Perchlorate Substitution RDT&E

Acquisition, Technology and Logistics

- **Replacement of Perchlorate in Training**
  - Ground Burst Simulators & Hand Grenade Simulators
    - Account for majority of expended perchlorate on Army Training ranges
    - Production contract for replacement composition (black powder) was awarded in February 08; Full manufacturing production in 09
  - Booby Trap Simulator - Production of perchlorate free version expected in FY10
  - Training Rocket Warhead (2.75" Rocket) - Production as early as FY10, pending approval
  - Black Smoke for Battlefield Simulator - Transitioned to manufacturer, production expected in FY10
  - Yellow Smoke for Battlefield Simulator - Production could be in FY11
- **Perchlorate Free - Pyrotechnic Signal Flares**
  - M18 Red/Violate Smoke Grenades – demonstrating production ability now

# DoD Perchlorate Substitution RDT&E

Acquisition, Technology and Logistics

- **Perchlorate Free Solid Rocket Propellants**
  - Any replacements for ammonium perchlorate (AP) in solid rocket propellants must meet high performance specs and have a low environmental burden
    - Must be extremely stable – in use and in storage per insensitive munitions regulation
    - Must be able to last 20 years in storage
    - Must be highly reliable in all environments
  - Likely will require technology change in rocket motor engines
    - Long development/testing/manufacturing time frame

# 3 Repeated Myths

- 1. DoD has “lobbied” the White House to prevent EPA from regulating perchlorate**
  - Corollary: DoD has interfered with EPA’s process to assess and regulate perchlorate**
- 2. DoD is the prime source of perchlorate contamination in the nation’s drinking water**
- 3. DoD objects to a perchlorate regulation because of the enormous cleanup cost**

# Myth 1 – Lobbying Against Regulation

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- DoD has never expressed an opinion, written or verbal, as to whether perchlorate should be regulated.
- DoD has never taken any action to dissuade EPA from regulating perchlorate.
- **As a member of an inter-agency work group (IWG), DoD did comment on the underlying science in EPA's 2002 draft perchlorate risk assessment. The IWG recommended to EPA that the National Academy of Sciences (NAS) do a peer review of the assessment.**
  - **In the 2005 NAS report, recommended a reference dose (RfD) for perchlorate which is still used today**
- **DoD did not participate in fall 2008 EPA meetings with “regulating” agencies to discuss the draft regulatory determination to not regulate perchlorate**
- **During normal inter-agency review, DoD did see the draft Oct 2008 EPA regulatory determination notice on perchlorate and made one minor comment to clarify a sentence.**
- **DoD did respond to EPA's May 2009 request for more information on the draft regulatory determination. DoD commented on the science and data analysis but did not opine on whether to regulate.**

# Myth 2 – DoD is the Source of Contamination of Drinking Water

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- **DoD uses perchlorate in munitions and missiles. Perchlorate is mostly stored or consumed (destroyed), not released.**
- **DoD has historic releases of perchlorate primarily at maintenance facilities, rocket testing, and disposal areas. Releases are known, mostly contained on bases, and do not threaten drinking water**
- **DoD has and continues to address these releases in coordination with regulators under CERCLA**
  - The RfD is used to assess risk and determine cleanup levels
  - A drinking water regulation is not needed to address releases.
- **DoD has taken about 52,000 samples at active & former properties.**
  - **There is no evidence of threats to current drinking water**
- **Joint initiative<sup>1</sup> with CA regulators screened 924 DoD sites that might have perchlorate contamination. None of the sites pose a threat to drinking water based on current data.**

<sup>1</sup> See article in December 2008 “Environmental Management” magazine



# Myth 3 – Perchlorate Regulation will Cause Large DoD Cleanup Liabilities

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- Perchlorate is a small percentage of total DoD cleanup liability
  - DoD can't quantify the exact costs of perchlorate because it is often cleaned up along with other contaminants – cost not broken out but not a large number of sites with perchlorate relative to inventory
- DoD perchlorate cleanups are done or in-progress already
- Establishment of a Maximum Contaminant Level (MCL) will not substantially affect DoD cleanups
  - MCL is a finished drinking water level, not a cleanup level. Cleanups are risk-based per CERCLA<sup>1</sup>
  - Cleanups are based on risk assessments which uses the RfD of 0.0007 mg/kg/day.
  - Some beneficial use groundwater cleanups might need to be marginally adjusted should a new MCL be established.
- DoD has no perchlorate violations in DoD drinking water systems at either state MCLs or EPA 15 ppb interim health level

<sup>1</sup> Comprehensive Environmental Response, Compensation and Liability Act

# Take-Away Messages

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- **DoD has acted responsibly regarding potential perchlorate releases**
- **Sampling continuing & response actions underway or completed, where warranted**
- **DoD does not appear to be the major source of perchlorate contamination nationwide**
  - Natural and a wide variety of non-DoD sources are likely responsible for low level, wide-spread contamination
  - New technologies can allow DoD/Regulators to identify sources
- **DoD investment in risk management measures such as treatment & substitution RDT&E continues**