

**RPM MEETING: SUMMARY**  
**NASA JET PROPULSION LABORATORY CERCLA SITE**

**Date/Time:** February 27, 2007/10:00 AM-1:30 PM  
(Meeting Notes Revised March 9, 2007)  
**Location:** Foothill Municipal Water District (FMWD) Office

**List of Attendees:**

- Steve Slaten (NASA)
- Merrilee Fellows (NASA)
- Mark Ripperda (U.S. EPA)
- Michel Iskarous (DTSC)
- Chuck Buriel (JPL)
- Judy Novelly (JPL)
- Bill Pecsai (FMWD)
- Bob Hayward (LAWC)
- Jeff O'Keefe (DHS)
- Alan Sorsher (DHS)
- Stefan Cajina (DHS)
- Gary Takara (City of Pasadena)
- Roumiana Karakanova (City of Pasadena)
- Brad Boman (City of Pasadena)
- Phyllis Currie (City of Pasadena)
- Shan Kwan (City of Pasadena)
- Inna Babbitt (City of Pasadena)
- Natalie Zwinkels (City of Pasadena)
- Diana Ayson-Fitzsimmons (City of Pasadena)
- Sun Liang (Metropolitan Water District)
- Mike Hart (Sunny Slope Water Company)
- Tony Zampielo (Raymond Basin Management Board)
- Pat Malloy (City of Arcadia)
- Steve Johnson (Stetson Engineers)
- Joon Min (Carollo Engineers)
- Mark Williams (WMI-Engineering)
- Dennis Williams (Geoscience)
- Georgina King (Geoscience)
- Nick Amini (Battelle)

Teleconference Participants:

- Susan Santos (Focus Group)
- Bruce Sass (Battelle)
- Keith Fields (Battelle)

**Attachments:**

- Agenda
- Presentation slides for Additional Investigation Results
- Presentation slides for the CERCLA Program Update
- Graph showing perchlorate levels in the Sunset Reservoir wells
- Graph showing perchlorate levels in the Pasadena East Site wells

Upcoming Meetings

- Teleconference: March 27 @ 10:00AM

## Summary and Action Items:

*Morning Session (10:00-12:00)*

### Presentation on the Additional Investigation

- Following introductions, Steve Slaten opened the meeting by providing some background information on the Additional Investigation. He explained that under CERCLA, NASA is required to determine the full extent of chemicals associated with the JPL site. The Additional Investigation was conducted fulfill that requirement and, more specifically, to determine if the perchlorate in the Sunset Reservoir wells originated from JPL. Steve went on to explain that the work plan for the Additional Investigation was put together in 2004 with input from the City of Pasadena and regulatory agencies, as well as an expert team consisting of university professors and technical staff from JPL, USGS, and Battelle. Extensive field work was conducted in 2005 and 2006 and NASA met their commitment to complete the technical memorandum by the end of January 2007. Steve noted that the City of Pasadena was briefed on the results of the additional investigation prior to public release. Steve noted that the Additional Investigation Technical Memorandum is available to the public via NASA's Web site (<http://jplwater.nasa.gov>) and he also offered to present the results to any interested group. Steve concluded his opening statements by indicating that he understands the importance of gaining consensus from the regulators and stakeholders to move the CERCLA process forward. Therefore, this meeting was an initial step in getting feedback from interested parties and working toward consensus.
- A PowerPoint presentation on the results of additional investigation was given by Steve Slaten (see attached). The results were presented for the four analytic tools used in the investigation:
  - Groundwater Geochemistry
  - Groundwater Modeling
  - Groundwater Chemical Concentration Data
  - Perchlorate Isotope DataSteve stressed the importance of looking at the results of these four tools in a holistic fashion and that with the tools taken together, NASA believes the combined results are compelling.
- Tony Zampiello requested a quick summary of where the cleanup was in the overall CERCLA process. Steve Slaten explained the status of each of the Operable Units. Steve noted that this Additional Investigation Technical Memorandum was one technical document that provides information to enable NASA to adequately define the extent of chemicals for the JPL CERCLA site. The information will ultimately become part of the final ROD for the site, which Steve indicated was a couple of years down the road. Steve reiterated NASA's commitment to clean up groundwater associated with historic practices at JPL.
- Some questions by Roumiana Karakanova and Alan Sorsher regarded the use of carbon tetrachloride as a tracer for chemicals originating from JPL. Steve Slaten stated that carbon tetrachloride is the best tracer for JPL chemicals because

significant quantities were used and disposed at the JPL facility during the 1940s and 1950s (the same time perchlorate was used) and there are no other known sources of carbon tetrachloride in the study area.

- Tony Zampiello asked about the perchlorate isotope data for the Las Flores Water Company Well No. 2 (LFWC#2). Steve Slaten noted that the isotope data indicates that the source of perchlorate in LFWC#2 is not JPL. It should also be noted that the isotope data is further confirmed by the capture zone predicted by the groundwater models (i.e., chemicals originating from JPL do not flow to LFWC#2) and by the absence of carbon tetrachloride in LFWC#2.
- In response to a comment from Mark Williams, there was discussion regarding the connection between the BMI Complex perchlorate isotope data and Colorado River perchlorate. Steve Slaten indicated that while it is widely understood that the BMI Complex is the source of the Colorado River perchlorate, no samples were available from the Colorado River water. Steve Johnson indicated that there is still perchlorate in Colorado River water and that NASA could collect samples for isotope analysis.
- Tony Zampiello asked about the margin of error for the isotope analysis. Steve Slaten indicated that the accuracy of the isotope data is roughly the size of the symbols used on the figures. Based on correspondence with Dr. Neil Sturchio, the accuracy of the isotope data is  $\pm 0.3\text{‰}$   $\delta^{18}\text{O}$  and  $\delta^{37}\text{Cl}$  and  $\pm 0.2\text{‰}$   $\Delta^{17}\text{O}$ .
- In response to a comment from Dennis Williams regarding natural perchlorate, Steve Slaten indicated that the  $\Delta^{17}\text{O}$  anomaly is believed to be a result of perchlorate formation in the upper atmosphere where chlorine species react with ozone.
- Alan Sorsher asked if it were possible that the source of perchlorate in the Bangham and Garfield wells is a mixture of natural and manmade perchlorate. Steve Slaten indicated that the presence of the  $\Delta^{17}\text{O}$  anomaly indicates that these samples do consist of a mixture of natural and synthetic perchlorate and were distinct from that of the JPL source.
- Georgina King asked why the perchlorate isotope data from MW-25 shows some influence of a  $\Delta^{17}\text{O}$  anomaly and Sunset Well does not. Steve Slaten suggested that the data indicates that natural perchlorate represents some fraction of the perchlorate in the samples collected from MW-25, but not from Sunset Well. He also noted that the closest well to MW-25 is Bangham, which does show the influence of the  $\Delta^{17}\text{O}$  anomaly.
- Bill Peci noted that although the Bangham well and Sunset well are relatively close together geographically their perchlorate isotope signatures are quite distinct. Steve Slaten said this indicates that multiple sources of perchlorate are present in the Sunset Reservoir area, which are distinct from the JPL source.
- Mark Williams asked whether there was any perchlorate isotope data for MW-24, located in the JPL source area. Keith Fields noted that samples were collected from this well; however, there was not sufficient quantity of perchlorate sample for UIC to obtain isotope results. All samples that yielded results have been included on the plots. Samples from MW-16 and the influent to the source area treatment system were analyzed by UIC and are representative of the JPL source area. During February 2006, when the first sample was collected from MW-16,

the perchlorate level in this well was approximately 13,000 µg/L (the highest of any source area well), making it the most logical choice for a representative source area sample.

- Dennis Williams noted that the historic perchlorate concentrations in MW-21 (Screen 1) are significantly higher than Colorado River water. Steve Slaten noted that this may be a result of higher perchlorate concentrations in the Colorado River water prior to 1997 or another source of perchlorate upgradient/cross-gradient of JPL. MW-21 is significantly influenced by imported water injections in the VWC wells (supported by elevated sulfate concentrations and tritium values), is not within the flow path of chemicals originating from the JPL facility based on groundwater modeling, and has never had detections of carbon tetrachloride. Therefore, the perchlorate detected in MW-21 is not associated with a JPL source.
- Georgina King asked about published papers which would support NASA's interpretations. Steve Slaten said that the use of isotopic analysis for fingerprinting is being increasingly used for these purposes. A number of relevant papers have been referenced in the technical memorandum. He made an additional point regarding the use of isotopic analysis to differentiate natural perchlorate from the synthetic, as well as to distinguish among various synthetic sources. Some examples of stable isotope analysis in the literature are cited in NASA's Technical Memorandum, and also are provided here:

Duncan, B.P., R.D. Morrision and E. Vavricka. 2005. "Forensic Investigation of Anthropogenic and Naturally Occurring Perchlorate." *Environmental Forensics*. 6:205-215.

Bao, H. and B. Gu. 2004. "Natural Perchlorate has a Unique Isotopic Signature." *Environmental Science and Technology*. 38:5073-5077.

Böhlke, J.K., N.C. Sturchio, B. Gu, J. Horita, G.M. Brown, W.A. Jackson, J. Batista, and P.B. Hatzinger. 2005. "Perchlorate Isotope Forensics." *Analytical Chemistry*. 77:7838-7842.

Sturchio, N.C., J.K. Böhlke, B. Gu, J. Horita, G.M. Brown, A. Beloso, Jr., L.J. Patterson, P.B. Hatzinger, W.A. Jackson, and J.R. Batista. 2006. "Stable Isotopic Composition of Chlorine and Oxygen in Synthetic and Natural Perchlorate." B. Gu, and J.D. Coates, eds., *Perchlorate- Environmental Occurrence, Interactions and Treatment*: Springer, New York, p. 93-109.

Motzer, W.E., T.K. Mohr, S. McCraven, and P. Stanin. 2006. "Stable and Other Isotope Techniques for Perchlorate Source Identification." *Environmental Forensics*. 7:89-100.

Dasgupta, P.K., P.K. Martinelango, W.A. Jackson, T.A. Anderson, K. Tian, R.W. Tock, and S. Rajagopalan. 2005. "The Origin of Naturally Occurring Perchlorate: The Role of Atmospheric Processes." *Environmental Science and Technology*. 39:1569-1575.

Sturchio, N.C., J. K. Böhlke, A. D. Beloso, S. H. Streger, L. J. Heraty and P. B. Hatzinger. 2007. "Oxygen and Chlorine Isotopic Fractionation During Perchlorate Biodegradation: Laboratory Results and Implications for

Forensics and Natural Attenuation Studies.” *Environmental Science and Technology*. 41 (In Press).

- Mark Ripperda expressed interest in seeing comments on the study from all stakeholders. He noted this report was NASA’s report and that the different agencies would be commenting and he encouraged others who were interested to provide comments as well.
- Mark Ripperda asked DHS if the Sunset Reservoir treatment system would have to go through a 97-005 permit process. Stefan Cajina indicated that since the source is not clear, DHS will have to take a close look at it. Alan Sorsher indicated that the work done for Monk Hill treatment facilities can be expanded to cover the Sunset treatment system. Jeff O’Keefe indicated that if perchlorate concentrations are over three times the California notification level then DHS may have the City of Pasadena go through the process. Stefan Cajina also mentioned that public perception is considered in determining the applicability of the 97-005 process. That is, a 97-005 process could be triggered if there is a high level of public interest in the water provision from particular wells.
- Gary Takara mentioned that the City of Pasadena sent out almost 150 flyers on the Sunset treatment system last Friday of a Notice of Intent to Adopt a Negative Declaration (for CEQA purposes).
- Merrilee Fellows asked if the Metropolitan Water District had conducted perchlorate isotope analysis on the Colorado River water. Sun Liang said they had not. Stefan Cajina mentioned that DHS would like to see perchlorate isotope analysis conducted on water from the Colorado River.
- Brad Boman asked about the reliability of the perchlorate isotope results. Keith Fields responded that Dr. Sturchio has multiple peer-reviewed papers in highly respected scientific publications (e.g., ES&T), indicating perchlorate isotope analysis is well accepted within the scientific community. (See citations above.)
- Roumiana Karakanova inquired about Dr. Sturchio’s role in interpreting the perchlorate isotope data. Keith Fields responded that Dr. Sturchio’s interpretations of data are consistent with NASA’s and that Dr. Sturchio was an integral part of the evaluation.
- Mark Williams questioned the availability of other perchlorate isotope studies that distinguished between synthetic sources of perchlorate. Keith Fields noted that Dr. Sturchio’s publications indicate that perchlorate isotope data can be used for this purpose.
- Sun Liang mentioned that he knows of another university that can perform perchlorate isotope analysis should NASA collect another round of samples. Mark Ripperda responded that we need to consider if additional sampling is necessary. Steve Slaten commented that, for any follow-on research, he would have to consider how the results of any such activities would add to the understanding of the Additional Investigation.
- Dennis Williams stated that the Raymond Basin Groundwater Model was prepared as a water management tool. NASA understands the limitations and strengths of the Raymond Basin Groundwater Model.

- Steve Johnson mentioned that there does not appear to be agreement on the conclusions of this study and that NASA should take action on the perchlorate in the Sunset Reservoir wells. Steve Slaten reiterated that he believes the results of all four tools provide compelling evidence that NASA is not the source of perchlorate in the Sunset Reservoir wells.
- Tony Zampielo indicated that NASA's additional investigation report is just an opinion, not a decision. NASA believes the Additional Investigation Technical Memorandum represents factual information, which has been carefully collected and evaluated. The conclusions of the report are well supported.
- Mark Ripperda mentioned that his initial interpretation of the additional investigation report is that there are multiple sources of perchlorate in the Sunset Reservoir wells and JPL may be one of the sources. He also indicated that EPA chemists were analyzing the report as well, and he was awaiting their comments and interpretation. Mark suggested that those interested review the report and provide comments. He then suggested there be a follow-up meeting to discuss those comments and NASA's responses.
- Sun Liang, representing Metropolitan Water District, stated that Metropolitan thinks the NASA additional studies' results are inconclusive. Again, NASA believes the Additional Investigation Technical Memorandum represents factual information, which has been carefully collected and evaluated. The conclusions of the report are well supported.
- **Action Item:** Those interested should submit comments to NASA. NASA will evaluate all comments and at a future RPM meeting, these comments and associated responses will be discussed.

*Afternoon Session (12:15-1:30)*

Operable Unit 3 Update

- Steve Slaten provided an update on the Lincoln Avenue Water Company (LAWC) system, the City of Pasadena System, and the Sunset Wells.
- Bob Hayward indicated that the LAWC system is running well.
- City of Pasadena System
  - NASA issued the draft final OU-3 Interim Record of Decision (ROD) on February 16, 2007.
  - Landscape companies will attend a site walk on Thursday at Windsor Reservoir site. The landscape work is expected to commence one week after the site walk and is expected to take two weeks to implement.
  - Demolition of the Air Stripper Plant was completed in February by installation of sump covers.
  - The selected vendor for the Monk Hill Treatment Plant was approved by PWP General Manager. PWP, Carollo and Battelle are working with the selected vendor on finalizing the system specifications.

- Sunset Wells
  - Currently no change in perchlorate levels in the City of Pasadena's Sunset Reservoir Wells and East Side Wells (see attached graphs), as compared with last quarter.
  - Garfield well has been off line since January.
  - Rehabilitation work on the Copelin well should be completed by June.
  - The City has sent out flyers (150) for the residents within a radius of 500 feet around Sunset well to inform them about the environmental status of the water treatment plant that will be constructed for this well.

#### Public Involvement Update

- Merrilee Fellows discussed the two community involvement sessions conducted on February 21 and 22. The attendance was below expected and most attendees were interested in the water treatment plant at the Windsor Reservoir site.

#### Operable Unit 1 Update

- Steve Slaten provided an update on the Source Area Treatment System, including key operational data (see attached slides).
- The OU-1 Interim ROD has been finalized.
- System expansion started yesterday (February 26) and should be completed in approximately 3 months.
- Disinfection of treated water at the source area plant has been successful and has increased the injection capacity of the reinjection wells.

#### Other Items

- NASA submitted the 4th Quarter 2006 technical memorandum on February 22.
- The Draft Operable Unit 2 Remedial Action Report was submitted on October 27, 2006 and no comments were received from the regulatory agencies. Mark Ripperda recommended that NASA proceed with issuing the final Remedial Action Report.