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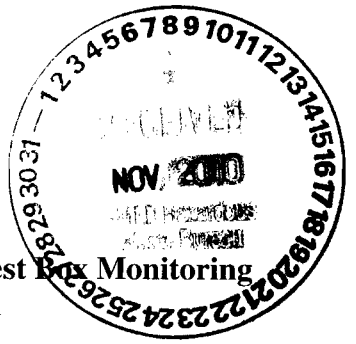
Date: NOV 08 2010
Refer To: EP2010-0511

James Bearzi, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303



Subject: Submittal of the Response to the Notice of Disapproval for the Nest Box Monitoring Report for the Upper Pajarito Canyon Watershed and Revision 1

Dear Mr. Bearzi:

Enclosed please find two hard copies with electronic files of the response to the notice of disapproval for the Nest Box Monitoring Report for the Upper Pajarito Canyon Watershed and Revision 1 of the report. Also enclosed is an electronic copy of a redline strikeout version of the report that includes all changes made in response to the New Mexico Environment's notice of disapproval dated October 8, 2010. A table detailing where revisions have been made to the report with cross-references to NMED's numbered comments is also included.

If you have any questions, please contact Steve Veenis at (505) 667-0013 (veenis@lanl.gov) or Suzy Schulman at (505) 606-1962 (sschulman@doeal.gov).

Sincerely,

Michael J. Graham, Associate Director
Environmental Programs
Los Alamos National Laboratory

Sincerely,

George J. Rael, Manager
Environmental Projects Office
Los Alamos Site Office

34095

MG/GR/DM/SV:sm

Enclosures: Two hard copies with electronic files:
(1) Response to the Notice of Disapproval for Nest Box Monitoring Report for the Upper Pajarito Canyon Watershed (LA-UR-10-7430)
(2) Nest Box Monitoring Report for the Upper Pajarito Canyon Watershed, Revision 1 (LA-UR-10-7429)
(3) An electronic copy of the redline-strikeout version of the plan that includes all changes and edits to the document
(4) Cross-reference table of NMED NOD comments and revisions to the report

Cy: (w/enc.)
Neil Weber, San Ildefonso Pueblo
Suzy Schulman, DOE-LASO, MS A316
Steve Veenis, EP-CAP, MS K490
RPF, MS M707 (w/ two CDs)
Public Reading Room, MS M992

Cy: (Letter and CD and/or DVD only)
Laurie King, EPA Region 6, Dallas, TX
Steve Yanicak, NMED-DOE-OB, MS M894
Randy Ryti, Neptune, Inc., Los Alamos, NM (w/ MS Word files on CD)
William Alexander, EP-BPS, MS M992

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Tom Skibitski, NMED-OB, Santa Fe, NM
Annette Russell, DOE-LASO (date-stamped letter emailed)
Craig Douglass, EP-CAP, MS M992 (date-stamped letter emailed)
Michael J. Graham, ADEP, MS M991 (date-stamped letter emailed)

Response to the Notice of Disapproval for the
Nest Box Monitoring Report for the Upper Pajarito Canyon Watershed
Los Alamos National Laboratory EPA ID No: NM0890010515, HWB-LANL-10-075,
Dated October 8, 2010

INTRODUCTION

To facilitate review of this response, the New Mexico Environment Department's (NMED's) comments are included verbatim. Los Alamos National Laboratory's (LANL's or the Laboratory's) responses follow each NMED comment.

SPECIFIC COMMENTS

NMED Comment

1. *The conclusion of the Report indicates that further characterization of metals for cavity-nesting birds and their food in the Pajarito watershed reaches is not warranted based on the exposure evaluation calculated using nest box insects collected in 2009. This conclusion is based upon limited data. Metals data (excluding mercury) were available for two sampling events (2007 and 2009), while mercury data were only available for a single sampling event (2009). As noted in the* Pajarito Canyon Biota Investigation Work Plan*, (July 2006) (IWP), "[t]he primary tool for risk characterization of potential effects on abundance is trend analysis versus predicted hazard quotient (HQ) for constituents of potential ecological concern (COPECs) (e.g., polychlorinated biphenyls (PCBs) and inorganic constituents). Concentrations in eggs and insects will be used to generate central tendency estimates and upper bound concentrations (95% upper confidence limit) of inorganic chemicals, PCBs, and semi-volatile organic chemicals (SVOCs) in eggs and insects."*

   Sufficient data have not been collected to adequately develop any trends or conduct statistical analyses. One year of data for mercury is not adequate to assess trends or develop a central tendency estimate or upper bound concentration. Based on the limited data provided in the Report, the date objectives of the biota investigation work plan have not been met and additional data for inorganics (in addition to the proposed PCB data) are needed.

LANL Response

1. Inorganic chemicals (including mercury) will be added to the analyses proposed in the report.

NMED Comment

2. *The IWP indicates that nest box studies will include an evaluation of the potential impacts from semi-volatile organic chemicals (SVOCs). It is not clear from the Report that sampling is proposed or planned for SVOCs. The Permittees must indicate when they will be evaluated or provide sound technical reasoning for not evaluating them.*

LANL Response

2. As stated in the NMED-approved Pajarito Canyon Investigation Report, Revision 1 (PCIR), "Cyanide and phthalate esters [bis(2-ethylhexyl)phthalate, di-n-butyl phthalate] were not measured in tissues,

but these COPECs have very limited spatial extent in sediments (Section 7.1, Table 7.1-1). Their omission does not represent a significant uncertainty for this assessment" (p. 84). LANL has added information on the frequency and magnitude of phthalate ester detections in the revised report to support this statement. Thus, LANL does not propose any additional monitoring for semivolatile organic compounds.

NMED Comment

3. *The nest box report further states that, "Other lines of evidence for evaluating risks to cavity-nesting birds include field measures of nest success. Such studies have not identified any potential for ecological risk in the Pajarito watershed. For example, robust evaluations based on a long record of observations of sex ratios of fledgling birds have shown no statistically significant differences in sex ratios between canyons or watersheds (Fair et al. 2009, 106686). Thus, there is no indication of contaminant effects on sex ratios across the monitoring network or based on the field measures of nest success evaluated in this report. Overall, the weight-of-evidence indicates that COPECs in the Pajarito reaches do not pose a potential risk to population abundance or persistence and species diversity of avian ground invertivore feeding guild species."*

   State whether the referenced data consist of a sole year or several years of observations (e.g., 2006 to present). The biota work plan indicates that shell thickness would also be monitored and that scatter plots to evaluate trends in nest success and eggshell thickness along gradients in elevation or COPEC concentrations will be developed. The Permittees must indicate whether or not these data have been collected. Discuss whether or not sufficient data have been collected to develop a trend analysis. The Permittees must indicate whether or not any robust analysis of all data has been conducted.

LANL Response

3. The Fair et al. report cited in PCIR is a comprehensive statistical analysis of gender ratios for the entire cavity-nesting bird monitoring network. The time period covered by these analyses was 1997 to 2008. Eggshell thickness or other measures of nest success were not evaluated by Fair et al. However, statistical analyses of nest success (including eggshell thickness) are presented in the NMED-approved PCIR in Appendix E (pp. E-3–E-4; Figures E-1.2-11 through E-1.2-34), which states, "there is no evidence of impairment of nesting success at Laboratory locations relative to reference locations" (p. E-2).

   Because additional analyses of insects collected from the cavity-nesting bird monitoring network is planned, LANL proposes to include an evaluation of the nest monitoring data in the subsequent report that will summarize these associated nest success results. These data (and an evaluation of the nest monitoring data) will be reported by August 31, 2011, or by August 31 of subsequent years if sample submission is delayed because of insufficient sample mass.

NMED Comment

4. *Several of the hazard quotients provided in Table 3 are significantly elevated (one to two orders of magnitude) compared to the target hazard level of 1.0. Based on the limited amount of available data combined with the elevated HQs, sufficient lines of evidence have not been provided to adequately demonstrate that there are no adverse impacts to cavity-nesting birds. Additional data and refinement of the risk assessment is needed to draw any conclusion as to impact on this class of birds.*

LANL Response

4. The largest magnitude of potential risks as indicated by hazard quotients (HQs) >1 was associated with the insects collected from reach AW-1 in 2007. The concentrations of cadmium, copper, lead, mercury, vanadium, and zinc in insect samples from reach AW-1 in 2007 led to the supplemental sampling in 2009. Much lower concentrations were measured in the 2009 samples from reach AW-1, and HQs were lower by 50% to more than an order of magnitude. The report states, "Therefore, concentrations of cadmium and lead in insects represent a potential for adverse ecological effects (based on the HQ > 1), and their distribution is consistent with a Laboratory source. Other than the 2007 samples, the maximum HQs for cadmium and lead were between 1 and 3" (p. 3). In addition, LANL proposes to include other information (such as a lowest observed adverse effect level analysis and more detailed data presentation of field observations of nest success) to support the assessment of risk for cavity-nesting birds. This information will be included in the report prepared by August 31, 2011, or by August 31 of subsequent years if sample submission is delayed because of insufficient sample mass.

NMED Comment

5. *In light of the results of recent air emissions modeling associated with Technical Area 16, dioxin/furan congeners must be included in the Upper Pajarito Canyon Biota Investigation.*

   NMED agrees with the Permittees that LANS must submit insects collected in 2010 from nest boxes in the upper Pajarito Canyon watershed reaches for SVOC, PCB, and dioxin/furan congener analyses if sufficient sample mass is available. If sample mass is insufficient for these analyses, samples from 2010 must be combined with samples from subsequent years. These data must be reported by August 31, 2011, or by August 31 of subsequent years if sample submission is delayed because of insufficient sample mass.

LANL Response

5. LANL agrees to add dioxins/furans to the analytical suite for insects collected from nest boxes in the upper Pajarito Canyon watershed. However, LANL offers three observations regarding this additional analysis. First, the reaches in the upper Pajarito Canyon watershed (e.g., AW-1) are approximately 1 mi from the Technical Area 16 burn units and the direction is northwest (not the direction of prevailing winds, which is to the northeast). Second, other sources of dioxins/furans can be found in this part of the Pajarito Canyon watershed, including post-fire deposits from the Cerro Grande fire. Third, to achieve appropriate detection limits, the analytical laboratory determined it will require 50 g of insects. Based on the previous sampling (Table 1 of the report), on average each nest box provides between 0.4 g and 0.8 g of insects per year. Given that the birds are territorial, each reach can include up to 10 boxes, and not all boxes may be occupied each year, a reach may supply between 2 g and 10 g of insects per year. Thus, it may take from 5 to 25 yr to obtain sufficient sample mass for dioxins/furans, if all else is excluded.

   Given these observations on the dioxin/furan chemical analysis of nest box insects, it is suggested that sample masses collected be reviewed annually to determine if sampling should continue or a report should be prepared, based on the continuing field observations of nesting success as well as the available analytical results from nest box insects.

Cross-Reference of NMED NOD Comments and Revisions to Nest Box Monitoring Report for the Upper Pajarito Canyon Watershed

NMED NOD Comment No.	Summary of NOD Comment Requirement	Section(s) in Original Report	Section(s) in Revised Report	Nature of Revision
Specific Comments				
1	Provide additional data for inorganic chemicals in addition to polychlorinated biphenyls.	p. 3	p. 3	Added inorganic chemicals to analytical suite.
2	Clarify if sampling is proposed or planned for semivolatile organic compounds (SVOCs) and indicate when they will be evaluated, or provide a sound technical reason for not evaluating them.	n/a	p.1	Added text explaining why SVOCs will not be analyzed.
3	State whether robust analyses of all data have been conducted.	p. 3	p. 3	Clarified time period for assessment of gender ratios and added statement that nest monitoring data will be evaluated in the follow-up report.
4	Add data and refine the risk assessment to draw any conclusion as to impact on cavity-nesting birds.	p. 3	p. 3	Deleted text stating that further evaluation of cavity-nesting birds and their food.
5	Include dioxin/furan congeners in the insect chemical analyses.	n/a	p. 3	Included dioxins and furans in the analyses with caveats. Added Table 4 to report to present detection limits and sample mass required for each analysis.

*n/a = Not applicable.

Nest Box Monitoring Report for the Upper Pajarito Canyon Watershed, Revision 1

Introduction

This report presents analytical data obtained in 2010 from insect samples collected in the upper Pajarito Canyon watershed at Los Alamos National Laboratory (LANL or Laboratory), as specified in the "Nest Box Monitoring Plan for the Upper Pajarito Canyon Watershed" (the monitoring plan) (LANL 2009, 108170) and approved by the New Mexico Environment Department (NMED) (2010, 109015). This report addresses uncertainties in exposure from chemicals of potential ecological concern (COPECs) for invertebrate-eating birds. This report was revised based on a notice of disapproval (NOD) from NMED (2010, 110957).

The study design COPECs for the cavity-nesting bird studies that are included in this report are the metals cadmium, copper, lead, mercury, vanadium, and zinc and the polychlorinated biphenyls (PCBs) Aroclor-1248 and Aroclor-1254, based on the evaluation presented in the "Pajarito Canyon Investigation Report, Revision 1" (PCIR) (LANL 2009, 106939, p. 77). Bis(2-ethylhexyl)phthalate was detected in 17 out of 345 sediment samples, and di-n-butyl phthalate was detected in 5 out of 345 sediment samples (LANL 2009, 106939, Appendix C, Table C-1.1-2). Overall, these COPECs were detected in fewer than 5% of the samples and also in no more than 7 of the 32 reaches sampled. In addition, the detected concentrations of these phthalate esters were within the range of nondetected sample results. Thus, phthalate esters [bis(2-ethylhexyl)phthalate, di-n-butyl phthalate] were not measured in tissues because these COPECs have very limited spatial extent in sediment and, as stated in PCIR, their omission does not represent a significant uncertainty for this assessment (LANL 2009, 106939, p. 77). Therefore, semivolatile organic compounds were not among the suites analyzed for in the insect tissues. As discussed in the PCIR, insects collected from nest boxes in five sediment investigation reaches in 2007 were analyzed for inorganic COPECs. The concentrations of some COPECs in insects collected from a single location in reach AW-1 were greater than other Pajarito watershed insect samples and were well outside the range of concentrations reported from other canyons. In addition, no analyses were obtained for mercury or PCBs because of insufficient sample mass. The single set of relatively high results, the small number of samples, and the incomplete analytical suite resulted in uncertainties concerning potential ecological risk. Therefore, additional analytical data were obtained from insect samples collected in 2009 to address these uncertainties.

Approach

Insects collected from nest boxes occupied in 2009 in reaches AW-1, PAS-1E, and TWSE-1W, which are close to contaminant sources, were analyzed for key COPECs, as allowed by available sample mass and target detection limits and as specified in the monitoring plan (LANL 2009, 108170). In addition, analyses were performed on insect samples collected from nest boxes on an adjacent mesa in Technical Area 14 (TA-14), which serves as a local reference area. The monitoring plan also specified analyses of insects collected from a downcanyon reach, PA-2W, but sample mass was not sufficient for any analyses from this reach. Nest box locations are shown in Figure 8.1-1 of the PCIR (LANL 2009, 106939, p. 145). Insects were sorted from other items collected from the nest boxes, weighed, and identified before analysis. Insects from each reach were composited to increase sample mass before submittal to analytical laboratories.

Insect samples were analyzed using up to three methods, dependent on available sample mass. Metals obtained with the U.S. Environmental Protection Agency (EPA) Method 6010A (including cadmium, copper, lead, vanadium, and zinc) were obtained first, followed by mercury using EPA Method 7471 and PCBs using EPA Method 8082, if sufficient sample mass was available. The target detection limits are

specified in the monitoring plan (LANL 2009, 108170). Table 1 presents dry weights for insects collected from each area in 2009 and analyses performed. Concentrations of COPECs in insects from 2007 and 2009 were qualitatively tested for relationships with reproductive parameters of nest productivity.

Results

The insects collected from nest boxes in the three reaches and the TA-14 reference area in 2009 had sufficient mass for analyses of metals using EPA Method 6010A and mercury using EPA Method 7471. In addition, there was sufficient sample mass to analyze the insects collected from reach TWSE-1W for PCBs. These data are presented in Attachment 1 (on CD included with this document).

Table 2 presents a comparison of metals concentrations in the 2009 samples with previous data obtained from the Pajarito watershed in 2007 (LANL 2009, 106939) and other areas in 2005 (Colestock 2007, 102994). The concentrations of all metals in this table from the 2007 AW-1 samples, except copper, were higher than all other samples in this data set, showing that the 2007 AW-1 results were anomalously high and were not reproduced in the 2009 samples. The concentrations reported for the 2009 insect samples were within the range of values reported from the other sites with the exception of cadmium and lead, which were highest in AW-1. Therefore, the analytical data from 2009, in combination with the 2007 data, indicate elevated cadmium and lead in insects in this reach. These metals also have higher concentrations in sediment samples from AW-1 than the other reaches sampled for insects (LANL 2009, 106939).

The potential dose to robins as representative invertebrate-eating birds was calculated using the metals concentrations in the insects collected from the nest boxes, following the process used in previous investigations (LANL 2009, 106939). The equation for calculating hazard quotients (HQs) was presented in Section 8.1.3.2 of the PCIR (LANL 2009, 106939, p. 74), and exposure parameters for the robin are from the screening-level ecological risk assessment methods document (LANL 2004, 087630, p. 37) and are listed in Appendix E-1.0 of the PCIR (LANL 2009, 106939). The toxicity reference values (TRVs) used for the robin are from the Ecorisk Database, Version 2.4 (LANL 2009, 107524), and the TRVs for cadmium, copper, and zinc differ from those used in the PCIR (although none of these had any significant changes).

Table 3 shows the calculated HQs for the robin based on exposure to concentrations measured in nest box insects. In all cases, there is a single sample result for insects in each reach for a given year. Table 3 displays all results for the food pathway if the HQ for a COPEC in any reach was greater than 1. Aroclor-1248 and Aroclor-1254, which were study design COPECs for avian studies, were not detected in the TWSE-1W sample and were not included in the exposure evaluation. Aroclor-1260 was detected in reach TWSE-1W insects, and the associated pathway HQ was 0.1.

The HQs for the insect ingestion pathway are shown in Table 3 and predict a potential for adverse ecological effects. The exposure evaluation for the robin also identifies reaches where COPECs have HQs greater than 1. HQs greater than 1 were observed for all reaches or locations where insects were sampled (AW-1, PAS-1E, PA-2W, PA-3E, TWSE-1W, and TA-14 mesa). Much lower concentrations were measured in the 2009 samples from reach AW-1, and the HQs were lower by 50% to more than an order of magnitude. Note that the TA-14 mesa location was selected as a reference comparison location for the Pajarito watershed reaches.

Calculating exposure to be greater than the effect level (as the HQ > 1 suggests) is one factor in establishing a linkage between contamination and ecological effects. Another consideration is the relationship of exposure to potential contamination sources. In the Pajarito watershed, reaches AW-1, PAS-1E, and TWSE-1W are closest to contaminant sources and therefore are expected to have greater

levels of contamination than other reaches. Reaches AW-1 and PAS-1E have the highest exposure concentrations and HQs for the 2007 insect pathway results for five of the six COPECs in Table 3 (all but copper*).* This trend does not hold for the majority of the 2009 insect sample results, and potential exposures, and the HQs are comparable for four of the six COPECs (copper, mercury, vanadium, and zinc). However, insect concentrations of cadmium and lead in 2009 are greatest in reach AW-1, with lower concentrations reported in PAS-1E and other locations (Table 3). Therefore, concentrations of cadmium and lead in insects represent a potential for adverse ecological effects (based on the HQ > 1), and their distribution is consistent with a Laboratory source. Other than the 2007 samples, the maximum HQs for cadmium and lead were between 1 and 3.

Other lines of evidence for evaluating risks to cavity-nesting birds include field measures of nest success. Such studies have not identified any potential for ecological risk in the Pajarito watershed. For example, robust evaluations based on the 1997 to 2008 record of observations of sex ratios of fledgling birds have shown no statistically significant differences in sex ratios between canyons or watersheds (Fair et al. 2009, 106686). Thus, there is no indication of contaminant effects on sex ratios across the monitoring network or based on the field measures of nest success evaluated in this report. Overall, the weight-of-evidence indicates that COPECs in the Pajarito reaches do not pose a potential risk to population abundance or persistence and species diversity of avian ground invertivore feeding guild species.

Submission of additional insect samples for analysis of metals, PCBs, and dioxins and furans is proposed for the following reasons. Additional data on inorganic chemicals, including mercury, was requested by NMED in its NOD because of the limited data set (NMED 2010, 110957). Additional data on PCBs are proposed because no PCB data have been obtained from insects from the reach with the highest concentrations in sediment, AW-1, and the potential effects of PCBs on cavity-nesting birds in this reach remains an uncertainty. Data on dioxin and furan congeners was requested by NMED in its NOD because of potential air dispersion from TA-16 (NMED 2010, 110957). The Laboratory will submit insects collected in 2010 from nest boxes in the upper Pajarito Canyon watershed reaches for these analyses if sufficient sample mass is available. Sample mass requirements, as provided by the analytical laboratory, are summarized in Table 4. If sample mass is insufficient for all chemical analyses, samples from 2010 will be combined with samples from subsequent years. These data and an evaluation of the associated field nest monitoring observations will be reported by August 31, 2011, or by August 31 of subsequent years if sample submission is delayed because of insufficient sample mass.

References

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

Colestock, K.L., 2007. "Landscape Scale Assessment of Contaminant Effects on Cavity-Nesting Birds," master's thesis for a Master of Science in Ecology, Utah State University, Logan, Utah. (Colestock 2007, 102994)

Fair, J.M., R.T. Ryti, M.D. Jankowski, and S.L. Reneau, August 10, 2009. "Sex Ratio and Contaminant Impacts on Reproduction: Adaptive and Environmental Constraints," Los Alamos National Laboratory document LA-UR-09-05092, Los Alamos, New Mexico. (Fair et al. 2009, 106686)

LANL (Los Alamos National Laboratory), December 2004. "Screening-Level Ecological Risk Assessment Methods, Revision 2," Los Alamos National Laboratory document LA-UR-04-8246, Los Alamos, New Mexico. (LANL 2004, 087630)

LANL (Los Alamos National Laboratory), July 2006. "Pajarito Canyon Biota Investigation Work Plan," Los Alamos National Laboratory document LA-UR-06-4106, Los Alamos, New Mexico. (LANL 2006, 093553)

LANL (Los Alamos National Laboratory), August 2009. "Pajarito Canyon Investigation Report, Revision 1," Los Alamos National Laboratory document LA-UR-09-4670, Los Alamos, New Mexico. (LANL 2009, 106939)

LANL (Los Alamos National Laboratory), December 2009. "Nest Box Monitoring Plan for the Upper Pajarito Canyon Watershed," Los Alamos National Laboratory document LA-UR-09-8073, Los Alamos, New Mexico. (LANL 2009, 108170)

LANL (Los Alamos National Laboratory), December 2009. "Ecorisk Database (Release 2.4)," on CD, LA-UR-09-7834, Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 2009, 107524)

LANL (Los Alamos National Laboratory), August 2010. "Nest Box Monitoring Report for the Upper Pajarito Canyon Watershed," Los Alamos National Laboratory document LA-UR-10-5469, Los Alamos, New Mexico. (LANL 2010, 110525)

NMED (New Mexico Environment Department), February 12, 2010. "Notice of Approval, Nest Box Monitoring Plan for the Upper Pajarito Canyon Watershed," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M. Graham (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2010, 109015)

NMED (New Mexico Environment Department), October 8, 2010. "Notice of Disapproval, Nest Box Monitoring Report for the Upper Pajarito Canyon Watershed," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M. Graham (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2010, 110957)

Table 1
Nest Box Insect Samples Collected and Analyses Performed

Area	Sample ID	Location ID	EPA 6010A Metals and EPA 7471 Mercury	PCBs	Nest Box Numbers	Sample Weight (g)	Average Sample Weight per Box (g)
Reach AW-1	CAPA-10-15045	PA-611896	X	—*	843, 844, 845, 847, 848	2.25	0.45
Reach PAS-1E	CAPA-10-15046	PA-611897	X	—	850, 852, 854, 855, 856, 857	2.50	0.42
Reach TWSE-1W	CATW-10-15049	TW-611900	X	X	831, 832, 833, 834, 835, 836, 837, 839, 840, 841	7.92	0.79
TA-14 mesa	CAPA-10-15048	PA-611899	X	—	823, 826, 827, 830	2.20	0.55

* — = No analyses performed.

Table 2
Comparison of Metals Concentrations in Insects

COPEC	Reach AW-1 2009 Concentration (mg/kg)	Reach AW-1 2007 Concentration (mg/kg)	2009 Concentration Range (mg/kg)	2007 Concentration Range, Excluding AW-1 (mg/kg)	2005 Concentration Range (mg/kg)
Cadmium	2.1	7.7	0.29–2.1	0.27–1.2	0.015–0.72
Copper	11	38	11–17	11–45	0.85–93
Lead	2.8	130	0.81–2.8	0.45–1.7	0.024–1.8
Mercury	0.044	—*	0.037–0.076	—	—
Vanadium	0.67	4.1	0.59–1.9	0.39–1.5	0.24–3.6
Zinc	95	5000	95–120	88–220	8.6–210

* — = No data.

Table 3
Exposure Evaluation for the Robin Based on the Insect Pathway

COPEC	Year	Reach	Sample Result (mg/kg)	Pathway HQ
Cadmium	2007	AW-1	7.7	8.0
		PAS-1E	1.2	1.2
		PA-3E	0.82	0.8
		TWSE-1W	0.33	0.3
		PA-2W	0.27	0.3
	2009	AW-1	2.1	2.2
		PAS-1E	0.5	0.5
		TWSE-1W	0.34	0.4
		TA-14 mesa	0.29	0.3
Copper	2007	PA-3E	45	16.9
		AW-1	38	14.3
		PA-2W	25	8.4
		TWSE-1W	18	6.8
		PAS-1E	11	4.1
	2009	PAS-1E	17	6.4
		TWSE-1W	17	6.4
		TA-14 mesa	14	5.3
		AW-1	11	4.1
Lead	2007	AW-1	130	121
		PAS-1E	1.7	1.6
		TWSE-1W	1.6	1.5
		PA-3E	1.5	1.4
		PA-2W	0.45	0.4
	2009	AW-1	2.8	2.6
		PAS-1E	2.4	2.2
		TWSE-1W	1.8	1.7
		TA-14 mesa	0.81	0.8
Mercury	2009	TA-14 mesa	0.076	6.1
		TWSE-1W	0.059	4.7
		AW-1	0.044	3.5
		PAS-1E	0.037	3.0

Table 3 (continued)

COPEC	Year	Reach	Sample Result (mg/kg)	Pathway HQ
Vanadium	2007	AW-1	4.1	18.1
		PAS-1E	1.5	6.6
		TWSE-1W	1.4	6.2
		PA-3E	1.1	4.9
		PA-2W	0.39	1.7
	2009	TWSE-1W	1.9	8.4
		PAS-1E	1.7	7.5
		AW-1	0.67	3.0
		TA-14 mesa	0.59	2.6
Zinc	2007	AW-1	5000	115
		PA-3E	220	5.1
		PAS-1E	180	4.1
		PA-2W	100	2.3
		TWSE-1W	88	2.0
	2009	TA-14 mesa	120	2.8
		TWSE-1W	110	2.5
		PAS-1E	100	2.3
		AW-1	95	2.2

Note: Cells are highlighted if the HQ is >1.

Table 4
Target Detection Limits and Required Sample Mass for Insects

Suite	COPEC	Chemical Abstract Service ID	Analytical Method	Target Minimum Quantitation Limit (mg-COPEC/kg-fresh wt insect)	Required Insect Dry Weight (g)
Metal	Cadmium	7440-43-9	EPA Method 6020/6010B	1.12	0.44
Metal	Copper	7440-50-8	EPA Method 6020/6010B	1.96	0.51
Metal	Lead	7439-92-1	EPA Method 6020/6010B	1.05	0.29
Metal	Mercury	7439-97-6	EPA Method 7471A	0.01	0.6
Metal	Vanadium	7440-62-2	EPA Method 6010B	0.72	1.40
Metal	Zinc	7440-66-6	EPA Method 6010B	24.8	0.081
PCB	Aroclor-1248	12672-29-6	EPA Method 8082	0.016	12.65
PCB	Aroclor-1254	11097-69-1	EPA Method 8082	0.07	2.89
Dioxin	2,3,7,8-TCDD	1746-01-6	EPA Method 8290	9.1E-07	50

Modified from Pajarito Canyon Biota Investigation Work Plan (LANL 2006, 093553, Table 5.1-2).