ROCKY MOUNTAIN ARSENAL

NATIONAL WILDLIFE REFUGE

Bison Tissue Contaminant Study
Data Summary Report

Revision 0
May 3, 2016

Final Document
(includes response to comments received from Regulatory Agencies & comment resolution that occurred at an April 20, 2016 face-to-face meeting)

USFWS

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ACRONYMS AND ABBREVIATIONS

ARDL	Applied Research and Development, Inc.
Army	United States Department of the Army
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response Compensation Liability Act
COPC	Chemical of Potential Concern
BTSC	Bison Tissue Contaminant Study
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DQOs	Data Quality Objectives
DSR	Data Summary Report
EPA	United States Environmental Protection Agency
FFA	Federal Facility Agreement
FS	Feasibility Study
HH	Human Health
ICP	Inductively Coupled Plasma
IEA/RC	Integrated Endangerment Assessment/Risk Characterization
LCS	Laboratory Control Spike
MS	Matrix Spike
NPL	National Priority List
OCP	Organochlorine Pesticide
OMC	Operations and Maintenance Contractor
OU	Operable Unit
PE	Performance Evaluation
QA	Quality Assurance
QC	Quality Control
RI	Remedial Investigation
RL	Reporting Limit
RMANWR	Rocky Mountain Arsenal National Wildlife Refuge
RMA	Rocky Mountain Arsenal
RMAED	Rocky Mountain Arsenal Environmental Database
RPD	Relative Percent Difference
RVO	Remediation Venture Office
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SQAPP	Sampling Quality Assurance Project Plan
SSRBSL	Site-Specific Risk-Based Screening Level
SWRI	Southwest Research Institute
TSL	Tissue Screening Level
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service

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1.0 INTRODUCTION

This Data Summary Report (DSR) has been developed to present the results of the Rocky Mountain Arsenal National Wildlife Refuge (RMANWR) Bison Tissue Contaminant Study (BTCS) and the review of associated Quality Control (QC) data.

The primary purpose of the BTSC was to provide contaminant concentrations in various bison tissues to determine if the FFA restriction prohibiting human consumption of RMA game could be revised for bison. There were three main objectives for the collection of these data including:

- Concentrations of OCPs and mercury in various bison tissues
- Determine if nonlethal sampling of bison fat was predictive of edible tissue concentrations
- Obtain tissue data adequate to quantify cancer and non-cancer risks to humans who may ingest RMA bison meat

These objectives were further refined in the Sampling and Analysis Plan **Analysis of Tissue and Tail Bulb Fat, 2014 Bison Necropsy Samples (SAP No. 2) Bison Tissue Contaminant Study, Revision H (April 30, 2015)**

- PART 1: Obtain measures of COPCs in bison tissues that will be adequate to allow reliable quantification of any cancer and non-cancer risk from ingestion of bison meat
- PART 2: Determine if the tail bulb fat is predictive of any human health risks from ingestion of bison tissues

Laboratory data for samples taken in support of the BTCS have been summarized and are provided in later sections. The analytical data contained in this report have been taken from the RMA Environmental Database (RMAED). Data have been subjected to computerized data verification routines as run by the RMA Database Support Contractor. The reported data have been subjected to the formal data validation process, thus the final accepted data are presented in this report.

2.0 BACKGROUND

2.1 Origination of the Rocky Mountain Arsenal and the National Wildlife Refuge

Located approximately ten miles from downtown Denver, portions of the land within the acquisition boundary of the Refuge (15,988 acres) have a well-documented history of significant environmental disturbance and contamination. The primary causes of contamination were the manufacture of chemical weapons by the U.S. Army from the World War II through Vietnam

eras and the production of pesticides by Shell Oil Company from 1950-1980. Common industrial and waste disposal practices resulted in contamination of structures, soil, surface water, and groundwater. As a result of this contamination, in 1987 the Rocky Mountain Arsenal (RMA) was placed on the National Priorities List (NPL) for environmental cleanup under the Comprehensive Environmental Response Compensation, and Liability Act (CERCLA).

The Rocky Mountain Arsenal National Wildlife Refuge (RMANWR) was authorized in 1992 and officially established in 2004 when the U.S. Environmental Protection Agency certified former U.S. Army lands to be transferred, through partial deletions from the NPL. In 2007, consistent with the purposes of the RMANWR, 16 bison were imported to emulate natural prairie processes and assist with habitat restoration. In order to effectively manage the bison herd, it is necessary to periodically remove animals. When appropriate and consistent with the Department of the Interior's Bison Conservation Initiative (U.S. Department of the Interior 2008), animals may be transferred to other national wildlife refuges. Animals may also be donated to Native American tribes or auctioned to the public. Whenever animals leave the RMANWR, it becomes possible that they could be consumed by the public at some point in the future.

As indicated above, portions of RMA have been deleted from the NPL site as the CERCLA remedy was completed. Partial deletion from the NPL are based on the determination by EPA and the Colorado Department of Public Health and Environment (CDPHE), that all appropriate response actions under CERCLA were completed (other than operation, maintenance, and five-year reviews) and there are no known hazardous substances above health-based levels remaining in the partial deletion areas, with respect to anticipated uses of and access to the site which are identified in the Federal Facility Agreement (FFA) (EPA et al 1989), the *Record of Decision for the On-Post Operable Unit* (ROD) (FWENC 1996), and Public Law 102-402.

2.2 Land Use Restrictions

Currently, over 14,700 acres have been transferred to the USFWS for establishment of the RMANWR with these land use restrictions in place.

The following restriction is currently found in the ROD:

> *The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 and the FFA restrict future land use, and prohibit certain activities such as agriculture, use of on-post groundwater as a drinking source, and consumption of fish and game taken at RMA (Foster Wheeler Environmental Corporation 1996).*

Organochlorine pesticides were produced on the site and are the principal contaminants of concern on the RMANWR (USFWS 2013b). Because it was not known whether consumption of

fish and game from the RMANWR might pose a human health risk, a land use restriction was included in the 1989 Federal Facility Agreement preventing consumption of fish and game from the property (EPA et al. 1989). This restriction was carried forward into the 1996 Record of Decision for the site. In April 2013, the U.S. Fish and Wildlife Service initiated a formal process to remove/modify this restriction to allow the RMANWR to manage its bison herd similar to other bison herds across the country, which would include removing surplus bison from the site.

2.3 RMANWR Habitat Development and Bison

Remediation activities mandated under CERCLA and subsequent restoration activities conducted by the USFWS are anticipated to return approximately 67 percent (10,739 acres) of Refuge lands to native short- and mixed-grass prairie. Other habitats that will be present on the Refuge include shrub lands, forested lands, riparian areas, and numerous manmade features (irrigation lakes, ditches, homesteads, etc.), many of which are of cultural or historic importance.

The USFWS Habitat Management Plan for the RMANWR (USFWS 2013a) identifies two high priorities for the Refuge, as follows: (1) to promote successful long-term establishment and maintenance of seeded restoration sites, existing native prairies and shrublands, and habitat for the resources of concern; and (2) maintain a bison (*Bison bison*) population that contributes to the Department of the Interior's Bison Conservation Initiative (U.S. Department of the Interior 2008) and helps maintain the structure and composition of native and restored prairies necessary to support priority grassland bird species (USFWS 2013a). Based upon an analysis of available forage and the habitat needs of all wildlife species, the USFWS developed the following objective for the RMANWR bison herd:

> *Manage bison populations, in support of the Department of the Interior's Bison Conservation Initiative, at or below the carrying capacity for the refuge. At present, bison populations would range between 25-40 animals and should not exceed 42 animals. Once additional grazing units and opportunities are fully in place, long-term bison populations would range between 110-180 animals and should not exceed 209 animals (USFWS 2013a).*

In order to implement this objective and effectively manage the RMANWR bison herd at or below carrying capacity, it is necessary to periodically remove animals from the Refuge. When appropriate and consistent with the Department of Interior's Bison Conservation Initiative (U.S. Department of the Interior 2008), it is desirable to transfer animals to other national wildlife refuges (U.S. Department of the Interior 2014). The USFWS would also like to be able to reduce the herd by making animals available to Native American tribes or by auctioning surplus animals to the public (USFWS 1996). However, whenever animals leave the Refuge, it becomes possible that they could be consumed by the public at some point in the future. Because consumption of RMA game is currently prohibited by the ROD and the FFA, it is necessary to determine if

RMANWR bison are safe for human consumption and, if so, eliminate or revise the game consumption prohibition through the appropriate ROD-change process and documentation. The purpose of the BTCS is to obtain data to inform both of these objectives.

3.0 SAMPLE COLLECTION AND ANALYSIS

This DSR summarizes bison tissue contaminant data collected in 2014 and 2015. New standards and detection limits were developed for these samples. This DSR does not include historical samples collected since bison arrived at the Refuge nor does it include initial live biopsies collected during the December 2013 roundup.

3.1 Sample Collection

The following detailed plans were followed to collect tissue samples from bison:

Bison Food Safety Program: Tissue Collection Plan (January 2014)

- This document describes collection of up to 68 samples from each bison plus (where applicable) fetal tissue and was developed ***specifically for use during the January 2014 necropsy event***.

Tissue Collection Plan (Ungulates) for contaminant analysis at the Rocky Mountain Arsenal NWR (December 2014)

- This document is an attachment to SAP 2.5 (December 2014) and SAP 2.0 (April 2015) and includes the "Fortuitous Sample Collection Checklist." This document describes the abbreviated collection of up to 10 samples from each bison and ***was used for all sample collection after January 2014***.
- Fortuitous sampling does not include analysis for total mercury.

The Bison Tissue Contaminant Study consists of the following major components:

- *Sampling and Analysis USDA Compliance Study Phase 1.0*[1]*:* This initial study effort was conducted by USFWS. The *Rocky Mountain Arsenal National Wildlife Refuge Sampling and Analysis Plan, USDA Compliance Study* (SAP 1.0) (USFWS 2013), dated December 16, 2013, was prepared by USFWS for implementation during the December 2013 bison roundup and was designed with two purposes:
    - To obtain 0.5 gram samples of fat tissue from a bison's posterior. Samples were collected from all one and two-year old bison during the roundup. The results of these samples are not included in this DSR.

[1] It is noted that SAP 1.0 and the January 2014 necropsy were conducted by the USFWS without concurrence by the Regulatory Agencies.

- To measure organochlorine pesticide levels in archived ("historic") tissue samples previously collected from animals that died since their arrival or birth on the RMANWR. The results of these samples are not included in this DSR.

- *January 2014 Necropsy[1]:* As a part of the December 2013 bison roundup, five animals were relocated to other national wildlife refuges, two euthanized animals were provided to Colorado State University for educational purposes, and eleven bison were euthanized. To maximize the use of euthanized animals, the USFWS completed necropsies for animal health purposes and completed extensive sample collection (n=68 plus fetal tissues where applicable) for future contaminant studies (USFWS 2014). The tissues were collected under the *Rocky Mountain Arsenal National Wildlife Refuge Sampling and Analysis Plan, Analysis of Tissue and Tail Bulb Fat, 2014 Necropsy Samples* (SAP 2.0) (USFWS 2015).

- *Bison Tail Head[2] Biopsy and Tissue Necropsy, December 2014*. During the December 2014 Bison Roundup, tail head fat biopsies were collected from 5 bison. In addition, 5 bison were euthanized and a necropsy was conducted. The biopsy and necropsy sampling was conducted in accordance with *Bison Tail Head[2] Biopsy and Tissue Necropsy Sampling and Analysis Plan* 2.5 (USFWS 2014b). This SAP was approved by the Regulatory Agencies prior to the December 2014 sampling event.

- *Fortuitous Sample Collection:* Collection and handling of fortuitous samples are described in SAP 2.5. Samples were collected from a bison euthanized in September 2014 (due to disease) and April 2015 (due to vehicle strike).

3.2 Sample Analysis

The samples obtained as part of the BTCS were analyzed for site-specific Chemicals of Potential Concern (COPCs) previously identified by the RMA baseline risk assessment (IEA/RC; EBASCO 1994) and additional target analytes identified by the Regulatory Agencies (see inset below from SAP 2.0). The BTCS detection limits for SAP 2.0 and SAP 2.5 are summarized in Table 4-2.

[2] Over the evolution of the bison sampling program, several terms were used to describe subcutaneous fat collected from the posterior of a bison (near its tail). The correct term is "tail-head biopsy," but is sometimes called "tail-bulb."

Selection of analytes for the Bison Tissue Contaminant study was based on review of the RMA Remedial Investigation (RI) (EBASCO 1989), a USFWS study of tissue contaminants in deer that was conducted before the remedy was initiated (Creekmore et al. 1999), a review of available soil contaminant data for the current bison pasture area, and an evaluation of bioconcentration potential and persistence conducted by the Regulatory Agencies. A two-stage review was conducted to select contaminants of potential concern (COPCs) for analysis of bison tissue samples. Based on the initial screen, 21 COPCs were proposed for evaluation of tissue consumption. The two major selection criteria were:

1. Historical presence at the RMA.
2. Bioaccumulation factor, as determined by the U.S. Environmental Protection Agency's (EPA's) Persistent, Bioaccumulative and Toxic (PBT) Profiler.

A due diligence review of potential COPCs at RMA was conducted, beginning with the original 666 chemicals identified in the Rocky Mountain Arsenal Chemical Index (G&M 1986) and then refining to a subset of those chemicals that are persistent and that bioaccumulate, by using the EPA PBT Profiler tool (EPA 2011b).

Based on evaluation of RMA COPCs, existing soil data from the bison pasture areas, historical RMA wildlife contaminant studies in deer, and bioconcentration potential and persistence; a total of 13 OCPs and one metal were selected as COPCs for this SAP. A summary of the rationale for identifying the COPCs is provided in Attachment A. The COPC list is presented in Table 4-1.

Two laboratories were used for the tissue contaminant analysis, but due to a change in detection limits this DSR only includes results from one laboratory.

- Southwest Research Institute analyzed the samples from SAP 1.0. These samples were analyzed with a requested detection limit of 0.1 mg/kg in fat in order to evaluate the dieldrin concentrations against the USDA Action Level in fat (USDA 2006).[3] The minimum detection limit achieved was 0.13 mg/kg. There were problems with the detection limit for some samples, possibly due to sample size. These data are not evaluated in this DSR. Samples analyzed by SWRI are not included in this DSR.
- ARDL analyzed samples obtained from SAP 2.0 and SAP 2.5. Sample shipping dates varied by SAP and in the case of the SAP 2.0 samples were different for biopsy and necropsy samples due to a delay in finalizing SAP 2.0.

All samples were analyzed for OCPs. Total mercury content was measured in kidney samples only.

[3] It is noted that SAP 1.0 and the January 2014 necropsy were conducted by the USFWS without concurrence by the Regulatory Agencies.

Table 3-1. Sample Collection Dates Compared to Sample Analysis		
	Sample Collection	***Sample Analysis***
Historic Samples	Multiple dates (2008, 2010, 2011, 2012)	SAP 1.0 (SWRI)
December 2013 Roundup	December 13, 2013	SAP 1.0 (SWRI)
January 2014 Necropsy	January 14-15, 2014	SAP 2.0 (ARDL) /a/
September 2014 Fortuitous	September 4, 2014	SAP 2.0 (ARDL) /a/
December 2014 Roundup	December 9, 2014	SAP 2.5 (ARDL) /a/
December 2014 Necropsy	December 10, 2014	SAP 2.5 (ARDL) /a/
April 2015 Fortuitous	April 4, 2015	SAP 2.0 (ARDL) /a/
/a/ Isodrin, hexachlorobenzene, and total mercury were added to the COPC list and included for laboratory analysis for SAP 2.0 and SAP 2.5		

4.0 DATA REVIEW

The purpose of the data review is to evaluate data quality with respect to the established data quality objectives (DQOs) as presented in the various SAPs (USFWS 2014a, 2014b 2015). The data evaluated in this report were collected in accordance with the various SAPs and the data evaluation is limited to the target analytes identified in the SAPs. Components of the data review process include; evaluating the data against the data quality indicators precision, accuracy/bias, representativeness, completeness, comparability and sensitivity; review of field and laboratory QC results; data validation of selected analytical data packages; and evaluating the data for suitability based on the intended use. Data validation activities were conducted in accordance with the RMA SQAPP (Navarro 2014b). The range of data reviewed consists of tissue samples collected from January 14, 2014 through April 6, 2015.

The QC data for each reported lot have been reviewed, including results reported for the laboratory control samples (LCS), method blanks (MB), and matrix spikes (MS) in each lot. Based on reported results and the review completed, the data quality meets or exceeds the established DQOs and provides defensible environmental data for potential future evaluations. All QC results and sample data are contained in the RMAED.

A detailed discussion of the data review results and the assessment of the data against the data quality requirements of precision, accuracy, representativeness, comparability, and completeness, is provided below. Since only samples from SAP 2.0 and SAP 2.5 had detection limits sufficiently low to compare to risk-based TSLs, only QC data associated with these samples will be evaluated

Data Review Results

Precision is defined as the measure of agreement among replicate measurements of the same property, under prescribed similar conditions. Precision data indicate how consistent and reproducible the field sampling or analytical procedures have been. The field duplicate and corresponding investigative sample result were used to calculate precision as the relative percent difference (RPD). RPD calculations less than or equal to 35 percent are considered acceptable.

Duplicate results are evaluated in conjunction with other QC criteria to determine if qualification of the data is necessary. The formula for calculating relative percent difference is:

$$RPD\ (\%) = \frac{(sample\ value - duplicate\ value)}{(sample\ value + duplicate\ value)/2} \times 100$$

A total of 16 duplicate analyses were evaluated for OCPs. The investigative result and the duplicate result were both below the reporting limit (RL) for all 16 of the analysis pairs. A summary of duplicate sample results is presented on Table 4-3.

A total of 4 duplicate analyses were evaluated for total mercury. One duplicate pair was below the RL. Three duplicate pairs reported detections. The RPD for the sample pairs with detections ranged from -9.5% to 33%. A summary of duplicate sample results is presented on Table 4-4.

The calculated RPD values are below the acceptable evaluation criteria of 35 percent.

Accuracy is the degree of agreement between an observed value (sample result) and an accepted reference value. Bias is the systematic or persistent distortion of a measurement process that causes errors in one direction (high or low). The terms accuracy and bias are used interchangeably in this DSR. Accuracy/bias is indicated by percent recovery calculated from laboratory spike data using the following formula:

$$Recovery\ Rate\ (\%) = \frac{measured\ value}{true\ value} \times 100$$

where:

measured value = the value after the spike – the value before the spike

true value = the value of the spike added

Accuracy/bias was calculated based on results of laboratory control spikes (LCS) and matrix spikes (MS). The acceptance range for MS recovery and LCS recovery was designated at 70 or 80 percent to 130 percent recovery in the BTSC SAPs. However, those ranges were based on what has been typically observed since recent applicable tissue data were not available prior to this effort. With the completion of this sampling effort, the laboratory has provided preliminary method-specific ranges for organic analytes based on the analyses performed. Although a limited number of lots were available to calculate limits, the method-specific ranges are considered more appropriate for the data review and are used here to evaluate accuracy. Additional tissue sampling efforts could provide more accurate method-specific limits. Method-specific ranges are provided in Table 4-5.

A total of 7 LCS samples were analyzed for OCPs and 3 LCS samples for mercury. OCP recoveries ranged from 51% to 112%. Mercury LCS recoveries were between 82% and 103%. A total of 3 MS samples were analyzed for OCPs and 1 MS sample for mercury. The range of OCP recoveries was 63% to 123%. The mercury MS recovery was 85%. LCS recoveries are listed in

Table 4-6. MS recoveries are listed in Table 4-7. All results are within the preliminary method-specific ranges provided by the lab.

However, the calculated MS and LCS recoveries were outside the default evaluation range specified in the SAPs for several analyses. As a conservative measure, additional data validation is performed when there are results outside the specified default evaluation ranges. Validation of the analytical data included evaluation of each step in the analytical process for method compliance. The sample collection documents, calibration standards, monitoring compounds, instrument performance checks, blanks, and quality control samples were evaluated based on method-specific quality control criteria. Quantitation reports, chromatograms, and case narratives were evaluated for accuracy. No unexpected trends or QC issues were observed in the investigative sample data, and there were no issues identified during validation that had an impact on data usability or resulted in qualification of the data. The data are considered acceptable for their intended use and no additional action is considered necessary.

Representativeness is a qualitative term achieved by evaluating whether measurements were made and samples were collected in a manner that the resulting data appropriately reflects the sampling unit. Representativeness was reviewed by evaluating the rinse and method blank results as specified in the SAP. A total of 7 OCP and 2 mercury method blank analyses were performed with no analyses above the RL. Based on the criteria identified in the SAP, the data are considered representative of the sampling unit.

Completeness is a measure of the amount of valid data obtained from a measurement system, expressed as a percentage of the number of valid measurements compared to the total number of measurements planned in the DQOs. The performance criterion is a completeness calculation result of greater than or equal to 90 percent. Completeness is calculated using the following formula:

$$Completeness\ (\%) = \frac{amount\ of\ valid\ data}{amount\ of\ valid\ data\ expected} \times 100$$

The project completeness calculation is 100 percent; therefore, the completeness criterion was achieved.

Comparability is a qualitative parameter that indicates the level of confidence with which one data set may be compared with another. Comparability is achieved by using standard techniques to collect and analyze representative samples and reporting data in appropriate units. The performance criterion specified in the SAP is the evaluation of the Performance Evaluation (PE) program sample results. However, no PE samples were submitted or analyzed for the BTCS, so comparability with other data sets could not be assessed.

Sensitivity is the ability of the method or instrument to detect the target analytes at the level of interest. The performance criterion for sensitivity is no analyte detections above the RL in the laboratory method blanks with the potential to impact the investigative results. As stated above

in the discussion on representativeness, there were no method blanks detections above the RL, thus the sensitivity criterion for the project is considered achieved.

Analytical Results

Samples were analyzed for OCPs and total mercury as identified on Table 1. OCPs were reported above the RL in one fat sample. Mercury was detected in 10/16 kidney samples. These results are summarized in Table 4-8. 18 animals and 112 tissue samples were non-detect for all OCPs and 6 animals were non-detect for mercury. One animal and one tissue had a detectable dieldrin concentration (0.021 mg/kg in fat). A total of 10 bison had detectable mercury concentrations (0.02 – 0.029 mg/kg). Complete sample analytical results are contained in Attachment A.

Data Evaluation

There was only one data point above the RL for OCPs and that was dieldrin. The dieldrin fat concentration was 0.021 mg/kg in a sample collected during the 2014 necropsy.

Mercury exceeded the RL in 10/16 samples. All detections for investigative samples were below the 0.030 SSRBSL for mercury identified in SAP 2.0. One duplicate sample reported a detection of 0.033 mg/kg.

A summary of the demographic data available for each animal in provided in Table 4-9.

5.0 SUMMARY

A summary of the analytical results is presented in Appendix A. A summary of the analytical results obtained from duplicate samples is presented in Appendix B. Data review based on the SAPs shows that the data are acceptable for the specified purposes. The SAP 2.0 and SAP 2.5 tissue samples had RLs consistent with SSRBSLs. All of the OCP samples for all tissues were non-detect for all OCPs with one exception. Dieldrin was detected in one fat sample at a concentration of 0.021 mg/kg.

Total mercury was detected above the RL in 10/16 kidney samples. All investigative mercury detections were below the SSRBSL of 0.03 mg/kg identified in SAP 2.0. One duplicate reported a detection of 0.033 mg/kg.

6.0 REFERENCES

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TABLE 4-1. COPCs

Table 1. Final list of Contaminants of Potential Concern (COPCs), Rocky Mountain Arsenal National Wildlife Refuge, Bison Tissue Study /a/

Aldrin
Chlordane
DDD
DDE
DDT
Dieldrin
Endrin
Endrin ketone
Heptachlor
Heptachlor epoxide
Hexachlorobenzene
Isodrin
Total mercury
Oxychlordane

/a/ Isodrin, hexachlorobenzene, and total mercury were added to the COPC list and included for laboratory analysis for SAP 2.0 and SAP 2.5

Table 4-2. Laboratory Method Detection Limits and Reporting Limits compared to the SSRBSLs

Contaminant of Potential Concern (COPC)	*Site-Specific Risk-Based Tissue Screening Levels for Bison Tissue (SSRBSLs) (mg/kg)*	*Laboratory Method Detection Limits Tissue*	*Laboratory Method Detection Limits Fat*
Aldrin	0.002	0.002	0.0126
Chlordane	0.050	0.001- 0.004	0.05
DDD	0.200	0.002	0.016
DDE	0.110	0.004	0.012
DDT	0.050	0.004	0.05
Dieldrin	0.002	0.002	0.004
Endrin	0.030	0.004	0.03
Endrin ketone /1/	-	0.004	0.039
Heptachlor	0.008	0.004	0.05
Heptachlor epoxide	0.001	0.001	0.016
Hexachlorobenzene	0.020	0.004	0.035
Isodrin /1/	-	0.002	0.05
Total mercury	0.030	0.02	NA
Oxychlordane /1/	-	0.004	0.05

/1/ Screening values are not calculated for isodrin, endrin ketone, and oxychlordane because there are no toxicity values available. Results for these three chemicals will be included with results for associated chemical: include isodrin and endrin ketone with endrin & include oxychlordane with chlordane.

Table 4-3. Duplicate Sample Analysis (OCPs from multiple tissues)

Sample Number /a/	Date	Tissue	Investigative & Duplicate Value (µg/g)
14BI934737	1/14/14	Fat	ND
14BI934737	1/14/14	Muscle	ND
14BI382519	1/14/14	Fat	ND
14BI396272	1/14/14	Muscle	ND
14BI396272	1/14/14	Liver	ND
14BI396272	1/14/14	Kidney	ND
14BI906520	1/14/14	Fat	ND
14BI065152	1/14/14	Muscle	ND
14BI065152	1/14/14	Kidney	ND
14BI065152	1/14/14	Liver	ND
14BI073062	1/14/14	Liver	ND
14BI073062	1/14/14	Kidney	ND
14BI075883	12/10/14	Kidney	ND
14BI080288	12/10/14	Muscle	ND
14BI089464	12/10/14	Fat	ND
14BI913364	12/10/14	Liver	ND

/a/ Sample number is identical to Site ID and equals [last two digits of year collected; “BI” for bison; and last six digits of an animal’s unique PIT chip]

Table 4-4. Duplicate Sample Analysis (Mercury obtained from kidney only)

Sample Number /a/	Date	Analyte	Investigative Boolean	Investigative Value (µg/g)	Duplicate Boolean	Duplicate Value (µg/g)	RPD
14BIO66551	1/14/14	Mercury		0.020		0.022	-9.5%
14BIO6520	1/14/14	Mercury		0.0029		0.0033	-12.9%
14BIO28889	12/10/14	Mercury	LT	0.02	LT	0.02	0%
14BI934737	1/14/14	Mercury	LT	0.02		0.028	33.3%

/a/ Sample number is identical to Site ID and equals [last two digits of year collected; “BI” for bison; and last six digits of an animal’s unique PIT chip]

Table 4-5. Method-Specific Spike Recovery Ranges

Method Number and Name	Analyte	Matrix Spike Recovery Ranges (percent)		Laboratory Control Spike Recovery Ranges (percent)	
		Lower Range	Upper Range	Lower Range	Upper Range
8081 - OCPs in tissue	Aldrin	0	133	46	114
	cis-Chlordane	0	147	46	118
	DDD	0	141	45	124
	DDE	0	151	44	121
	DDT	9	137	49	129
	Dieldrin	0	145	45	116
	Endrin	0	142	44	117
	Endrin ketone	0	144	41	121
	Heptachlor	12	154	40	144
	Heptachlor epoxide	22	130	40	123
	Hexachlorobenzene	5	148	54	121
	Isodrin	0	138	40	115
	Oxychlordane	0	139	35	119
	trans-Chlordane	0	156	42	132
7471 - Hg in tissue[1]	Mercury	80	130	80	130

[1]The standard recovery range used for mercury. There were not sufficient lots to calculate limits.

Table 4-6. Laboratory Control Spike Percent Recoveries

Analyte	Analysis Date	Lot Number	Boolean	LCS value (ug/g)	Spike Amount (ug/g)	Percent Recovery
ACLDAN	12/23/14	ACSX		0.00975	0.01	97.5%
ACLDAN	12/23/14	ACSY		0.184	0.2	92.0%
ACLDAN	5/27/15	ADFS		0.00617	0.01	61.7%
ACLDAN	5/27/15	ADFU		0.00778	0.01	77.8%
ACLDAN	5/29/15	ADGD		0.00891	0.01	89.1%
ACLDAN	5/29/15	ADGG		0.0083	0.01	83.0%
ACLDAN	6/3/15	ADGJ		0.151	0.2	75.5%
ALDRN	12/23/14	ACSX		0.00849	0.01	84.9%
ALDRN	12/23/14	ACSY		0.16	0.2	80.0%
ALDRN	5/27/15	ADFS		0.0056	0.01	56.0%
ALDRN	5/27/15	ADFU		0.00799	0.01	79.9%
ALDRN	5/29/15	ADGD		0.00906	0.01	90.6%
ALDRN	5/29/15	ADGG		0.00854	0.01	85.4%
ALDRN	6/3/15	ADGJ		0.169	0.2	84.5%
CL10BP	12/23/14	ACSX		0.00952	0.01	95.2%
CL10BP	12/23/14	ACSX		0.00986	0.01	98.6%
CL10BP	12/23/14	ACSY		0.158	0.2	79.0%
CL10BP	12/23/14	ACSY		0.205	0.2	102.5%
CL10BP	5/27/15	ADFS		0.0089	0.01	89.0%
CL10BP	5/27/15	ADFS		0.00668	0.01	66.8%
CL10BP	5/27/15	ADFU		0.00747	0.01	74.7%
CL10BP	5/27/15	ADFU		0.00919	0.01	91.9%
CL10BP	5/29/15	ADGD		0.00976	0.01	97.6%
CL10BP	5/29/15	ADGD		0.0106	0.01	106.0%
CL10BP	5/29/15	ADGG		0.00775	0.01	77.5%
CL10BP	5/29/15	ADGG		0.0103	0.01	103.0%
CL10BP	6/3/15	ADGJ		0.167	0.2	83.5%
CL10BP	6/3/15	ADGJ		0.185	0.2	92.5%
CL4XYL	12/23/14	ACSX		0.0103	0.01	103.0%
CL4XYL	12/23/14	ACSX		0.0101	0.01	101.0%
CL4XYL	12/23/14	ACSY		0.141	0.2	70.5%
CL4XYL	12/23/14	ACSY		0.201	0.2	100.5%
CL4XYL	5/27/15	ADFS		0.00708	0.01	70.8%
CL4XYL	5/27/15	ADFS		0.00586	0.01	58.6%

CL4XYL	5/27/15	ADFU		0.00673	0.01	67.3%
CL4XYL	5/27/15	ADFU		0.00731	0.01	73.1%
CL4XYL	5/29/15	ADGD		0.00744	0.01	74.4%
CL4XYL	5/29/15	ADGD		0.00892	0.01	89.2%
CL4XYL	5/29/15	ADGG		0.0051	0.01	51.0%
CL4XYL	5/29/15	ADGG		0.00717	0.01	71.7%
CL4XYL	6/3/15	ADGJ		0.132	0.2	66.0%
CL4XYL	6/3/15	ADGJ		0.153	0.2	76.5%
CL6BZ	12/23/14	ACSX		0.00928	0.01	92.8%
CL6BZ	12/23/14	ACSY		0.177	0.2	88.5%
CL6BZ	5/27/15	ADFS		0.00642	0.01	64.2%
CL6BZ	5/27/15	ADFU		0.00884	0.01	88.4%
CL6BZ	5/29/15	ADGD		0.0101	0.01	101.0%
CL6BZ	5/29/15	ADGG		0.00907	0.01	90.7%
CL6BZ	6/3/15	ADGJ		0.177	0.2	88.5%
DLDRN	12/23/14	ACSX		0.00872	0.01	87.2%
DLDRN	12/23/14	ACSY		0.167	0.2	83.5%
DLDRN	5/27/15	ADFS		0.00548	0.01	54.8%
DLDRN	5/27/15	ADFU		0.0081	0.01	81.0%
DLDRN	5/29/15	ADGD		0.00907	0.01	90.7%
DLDRN	5/29/15	ADGG		0.00847	0.01	84.7%
DLDRN	6/3/15	ADGJ		0.161	0.2	80.5%
ENDRN	12/23/14	ACSX		0.0081	0.01	81.0%
ENDRN	12/23/14	ACSY		0.166	0.2	83.0%
ENDRN	5/27/15	ADFS		0.0056	0.01	56.0%
ENDRN	5/27/15	ADFU		0.00823	0.01	82.3%
ENDRN	5/29/15	ADGD		0.00952	0.01	95.2%
ENDRN	5/29/15	ADGG		0.00881	0.01	88.1%
ENDRN	6/3/15	ADGJ		0.157	0.2	78.5%
ENDRNK	12/23/14	ACSX		0.00913	0.01	91.3%
ENDRNK	12/23/14	ACSY		0.176	0.2	88.0%
ENDRNK	5/27/15	ADFS		0.00522	0.01	52.2%
ENDRNK	5/27/15	ADFU		0.00798	0.01	79.8%
ENDRNK	5/29/15	ADGD		0.00874	0.01	87.4%
ENDRNK	5/29/15	ADGG		0.00854	0.01	85.4%
ENDRNK	6/3/15	ADGJ		0.168	0.2	84.0%
GCLDAN	12/23/14	ACSX		0.0096	0.01	96.0%
GCLDAN	12/23/14	ACSY		0.184	0.2	92.0%

GCLDAN	5/27/15	ADFS		0.00562	0.01	56.2%
GCLDAN	5/27/15	ADFU		0.00794	0.01	79.4%
GCLDAN	5/29/15	ADGD		0.00955	0.01	95.5%
GCLDAN	5/29/15	ADGG		0.00957	0.01	95.7%
GCLDAN	6/3/15	ADGJ		0.192	0.2	96.0%
HG	12/29/14	ACSZ		0.515	0.5	103.0%
HG	5/22/15	ADFW		0.41	0.5	82.0%
HPCL	12/23/14	ACSX		0.0111	0.01	111.0%
HPCL	12/23/14	ACSY		0.213	0.2	106.5%
HPCL	5/27/15	ADFS		0.00604	0.01	60.4%
HPCL	5/27/15	ADFU		0.00862	0.01	86.2%
HPCL	5/29/15	ADGD		0.0101	0.01	101.0%
HPCL	5/29/15	ADGG		0.00957	0.01	95.7%
HPCL	6/3/15	ADGJ		0.163	0.2	81.5%
HPCLE	12/23/14	ACSX		0.00965	0.01	96.5%
HPCLE	12/23/14	ACSY		0.183	0.2	91.5%
HPCLE	5/27/15	ADFS		0.00537	0.01	53.7%
HPCLE	5/27/15	ADFU		0.00773	0.01	77.3%
HPCLE	5/29/15	ADGD		0.00884	0.01	88.4%
HPCLE	5/29/15	ADGG		0.00817	0.01	81.7%
HPCLE	6/3/15	ADGJ		0.163	0.2	81.5%
ISODR	12/23/14	ACSX		0.00905	0.01	90.5%
ISODR	12/23/14	ACSY		0.169	0.2	84.5%
ISODR	5/27/15	ADFS		0.00522	0.01	52.2%
ISODR	5/27/15	ADFU		0.00768	0.01	76.8%
ISODR	5/29/15	ADGD		0.00858	0.01	85.8%
ISODR	5/29/15	ADGG		0.00794	0.01	79.4%
ISODR	6/3/15	ADGJ		0.146	0.2	73.0%
OCLDAN	12/23/14	ACSX		0.00932	0.01	93.2%
OCLDAN	12/23/14	ACSY		0.176	0.2	88.0%
OCLDAN	5/27/15	ADFS		0.00506	0.01	50.6%
OCLDAN	5/27/15	ADFU		0.00722	0.01	72.2%
OCLDAN	5/29/15	ADGD		0.00846	0.01	84.6%
OCLDAN	5/29/15	ADGG		0.0078	0.01	78.0%
OCLDAN	6/3/15	ADGJ		0.143	0.2	71.5%
PPDDD	12/23/14	ACSX		0.00877	0.01	87.7%
PPDDD	12/23/14	ACSY		0.167	0.2	83.5%
PPDDD	5/27/15	ADFS		0.00584	0.01	58.4%

PPDDD	5/27/15	ADFU		0.00835	0.01	83.5%
PPDDD	5/29/15	ADGD		0.0102	0.01	102.0%
PPDDD	5/29/15	ADGG		0.00893	0.01	89.3%
PPDDD	6/3/15	ADGJ		0.168	0.2	84.0%
PPDDE	12/23/14	ACSX		0.00902	0.01	90.2%
PPDDE	12/23/14	ACSY		0.169	0.2	84.5%
PPDDE	5/27/15	ADFS		0.00553	0.01	55.3%
PPDDE	5/27/15	ADFU		0.00842	0.01	84.2%
PPDDE	5/29/15	ADGD		0.00952	0.01	95.2%
PPDDE	5/29/15	ADGG		0.00878	0.01	87.8%
PPDDE	6/3/15	ADGJ		0.165	0.2	82.5%
PPDDT	12/23/14	ACSX		0.00881	0.01	88.1%
PPDDT	12/23/14	ACSY		0.169	0.2	84.5%
PPDDT	5/27/15	ADFS		0.00647	0.01	64.7%
PPDDT	5/27/15	ADFU		0.00914	0.01	91.4%
PPDDT	5/29/15	ADGD		0.0107	0.01	107.0%
PPDDT	5/29/15	ADGG		0.0101	0.01	101.0%
PPDDT	6/3/15	ADGJ		0.174	0.2	87.0%

Table 4-7. Matrix Spike Percent Recoveries

Sample Number /a/	Analyte	Matrix Spike Value (ug/g)	Matrix Spike Amount (ug/g)	Lot Number	Percent Recovery	Investigative Data Value* (ug/g)
14BI080288	ACLDAN	0.0112	0.01	ACSX	112.0%	0.0012
14BI028889	ACLDAN	0.155	0.2	ACSY	77.5%	-0.045
15BI0E0611	ACLDAN	0.169	0.2	ADGJ	84.5%	-0.031
14BI080288	ALDRN	0.00915	0.01	ACSX	91.5%	-0.00085
14BI028889	ALDRN	0.14	0.2	ACSY	70.0%	-0.06
15BI0E0611	ALDRN	0.188	0.2	ADGJ	94.0%	-0.012
14BI028889	CL10BP	0.00653	0.01	ACSX	65.3%	-0.00347
14BI028889	CL10BP	0.00641	0.0101	ACSX	63.5%	-0.00369
14BI028889	CL10BP	0.0146	0.0132	ACSX	110.6%	0.0014
14BI075883	CL10BP	0.0106	0.00995	ACSX	106.5%	0.00065
14BI075883	CL10BP	0.0288	0.0278	ACSX	103.6%	0.001
14BI075883	CL10BP	0.0134	0.0139	ACSX	96.4%	-0.0005
14BI080288	CL10BP	0.0112	0.01	ACSX	112.0%	0.0012
14BI080288	CL10BP	0.0101	0.01	ACSX	101.0%	1E-04
14BI080288	CL10BP	0.00977	0.01	ACSX	97.7%	-0.00023
14BI080288	CL10BP	0.012	0.0119	ACSX	100.8%	1E-04
14BI089464	CL10BP	0.00884	0.0111	ACSX	79.6%	-0.00226
14BI089464	CL10BP	0.0106	0.0101	ACSX	105.0%	0.0005
14BI089464	CL10BP	0.00987	0.00985	ACSX	100.2%	2E-05
14BI913364	CL10BP	0.00718	0.011	ACSX	65.3%	-0.00382
14BI913364	CL10BP	0.0102	0.0101	ACSX	101.0%	0.0001
14BI913364	CL10BP	0.00943	0.0101	ACSX	93.4%	-0.00067
14BI028889	CL10BP	0.208	0.222	ACSY	93.7%	-0.014
14BI028889	CL10BP	0.17	0.2	ACSY	85.0%	-0.03
14BI028889	CL10BP	0.193	0.2	ACSY	96.5%	-0.007
14BI075883	CL10BP	0.306	0.333	ACSY	91.9%	-0.027
14BI075883	CL10BP	0.188	0.2	ACSY	94.0%	-0.012
14BI080288	CL10BP	0.273	0.286	ACSY	95.5%	-0.013
14BI080288	CL10BP	0.192	0.2	ACSY	96.0%	-0.008
14BI089464	CL10BP	0.187	0.2	ACSY	93.5%	-0.013
14BI089464	CL10BP	0.181	0.2	ACSY	90.5%	-0.019
14BI913364	CL10BP	0.2	0.222	ACSY	90.1%	-0.022

14BI913364	CL10BP	0.184	0.2	ACSY	92.0%	-0.016
15BI0E0611	CL10BP	0.00763	0.01	ADFS	76.3%	-0.00237
15BI0E0611	CL10BP	0.00656	0.01	ADFS	65.6%	-0.00344
15BI0E0611	CL10BP	0.00696	0.01	ADFS	69.6%	-0.00304
15BI0E0611	CL10BP	0.191	0.2	ADGJ	95.5%	-0.009
15BI0E0611	CL10BP	0.208	0.2	ADGJ	104.0%	0.008
14BI028889	CL4XYL	0.0123	0.0132	ACSX	93.2%	-0.0009
14BI028889	CL4XYL	0.00547	0.01	ACSX	54.7%	-0.00453
14BI028889	CL4XYL	0.00635	0.0101	ACSX	62.9%	-0.00375
14BI075883	CL4XYL	0.00996	0.00995	ACSX	100.1%	1E-05
14BI075883	CL4XYL	0.0248	0.0278	ACSX	89.2%	-0.003
14BI075883	CL4XYL	0.0122	0.0139	ACSX	87.8%	-0.0017
14BI080288	CL4XYL	0.0111	0.01	ACSX	111.0%	0.0011
14BI080288	CL4XYL	0.0123	0.01	ACSX	123.0%	0.0023
14BI080288	CL4XYL	0.0105	0.01	ACSX	105.0%	0.0005
14BI080288	CL4XYL	0.00977	0.0119	ACSX	82.1%	-0.00213
14BI089464	CL4XYL	0.00757	0.0111	ACSX	68.2%	-0.00353
14BI089464	CL4XYL	0.00964	0.0101	ACSX	95.4%	-0.00046
14BI089464	CL4XYL	0.00802	0.00985	ACSX	81.4%	-0.00183
14BI913364	CL4XYL	0.00818	0.011	ACSX	74.4%	-0.00282
14BI913364	CL4XYL	0.00968	0.0101	ACSX	95.8%	-0.00042
14BI913364	CL4XYL	0.00869	0.0101	ACSX	86.0%	-0.00141
14BI028889	CL4XYL	0.223	0.222	ACSY	100.5%	0.001
14BI028889	CL4XYL	0.212	0.2	ACSY	106.0%	0.012
14BI028889	CL4XYL	0.217	0.2	ACSY	108.5%	0.017
14BI075883	CL4XYL	0.306	0.333	ACSY	91.9%	-0.027
14BI075883	CL4XYL	0.221	0.2	ACSY	110.5%	0.021
14BI080288	CL4XYL	0.281	0.286	ACSY	98.3%	-0.005
14BI080288	CL4XYL	0.205	0.2	ACSY	102.5%	0.005
14BI089464	CL4XYL	0.183	0.2	ACSY	91.5%	-0.017
14BI089464	CL4XYL	0.194	0.2	ACSY	97.0%	-0.006
14BI913364	CL4XYL	0.219	0.222	ACSY	98.6%	-0.003
14BI913364	CL4XYL	0.199	0.2	ACSY	99.5%	-0.001
15BI0E0611	CL4XYL	0.00637	0.01	ADFS	63.7%	-0.00363
15BI0E0611	CL4XYL	0.00667	0.01	ADFS	66.7%	-0.00333
15BI0E0611	CL4XYL	0.00565	0.01	ADFS	56.5%	-0.00435
15BI0E0611	CL4XYL	0.163	0.2	ADGJ	81.5%	-0.037
15BI0E0611	CL4XYL	0.175	0.2	ADGJ	87.5%	-0.025

14BI080288	CL6BZ	0.0106	0.01	ACSX	106.0%	0.0006
14BI028889	CL6BZ	0.156	0.2	ACSY	78.0%	-0.044
15BI0E0611	CL6BZ	0.207	0.2	ADGJ	103.5%	0.007
14BI080288	DLDRN	0.0101	0.01	ACSX	101.0%	1E-04
14BI028889	DLDRN	0.143	0.2	ACSY	71.5%	-0.057
15BI0E0611	DLDRN	0.19	0.2	ADGJ	95.0%	-0.01
14BI080288	ENDRN	0.0102	0.01	ACSX	102.0%	0.0002
14BI028889	ENDRN	0.125	0.2	ACSY	62.5%	-0.075
15BI0E0611	ENDRN	0.186	0.2	ADGJ	93.0%	-0.014
14BI080288	ENDRNK	0.0103	0.01	ACSX	103.0%	0.0003
14BI028889	ENDRNK	0.117	0.2	ACSY	58.5%	-0.083
15BI0E0611	ENDRNK	0.187	0.2	ADGJ	93.5%	-0.013
14BI080288	GCLDAN	0.0109	0.01	ACSX	109.0%	0.0009
14BI028889	GCLDAN	0.161	0.2	ACSY	80.5%	-0.039
15BI0E0611	GCLDAN	0.212	0.2	ADGJ	106.0%	0.012
14BI028889	HG	0.0798	0.0943	ACSZ	84.6%	-0.0145
14BI080288	HPCL	0.0123	0.01	ACSX	123.0%	0.0023
14BI028889	HPCL	0.195	0.2	ACSY	97.5%	-0.005
15BI0E0611	HPCL	0.186	0.2	ADGJ	93.0%	-0.014
14BI080288	HPCLE	0.0112	0.01	ACSX	112.0%	0.0012
14BI028889	HPCLE	0.157	0.2	ACSY	78.5%	-0.043
15BI0E0611	HPCLE	0.179	0.2	ADGJ	89.5%	-0.021
14BI080288	ISODR	0.0106	0.01	ACSX	106.0%	0.0006
14BI028889	ISODR	0.147	0.2	ACSY	73.5%	-0.053
15BI0E0611	ISODR	0.161	0.2	ADGJ	80.5%	-0.039
14BI080288	OCLDAN	0.0105	0.01	ACSX	105.0%	0.0005
14BI028889	OCLDAN	0.154	0.2	ACSY	77.0%	-0.046
15BI0E0611	OCLDAN	0.153	0.2	ADGJ	76.5%	-0.047
14BI080288	PPDDD	0.0113	0.01	ACSX	113.0%	0.0013
14BI028889	PPDDD	0.146	0.2	ACSY	73.0%	-0.054
15BI0E0611	PPDDD	0.193	0.2	ADGJ	96.5%	-0.007
14BI080288	PPDDE	0.0106	0.01	ACSX	106.0%	0.0006
14BI028889	PPDDE	0.149	0.2	ACSY	74.5%	-0.051
15BI0E0611	PPDDE	0.2	0.2	ADGJ	100.0%	0
14BI080288	PPDDT	0.00961	0.01	ACSX	96.1%	-0.00039
14BI028889	PPDDT	0.141	0.2	ACSY	70.5%	-0.059
15BI0E0611	PPDDT	0.193	0.2	ADGJ	96.5%	-0.007

/a/ Sample number is identical to Site ID and equals [last two digits of year collected; “BI” for bison; and last six digits of an animal’s unique PIT chip]

Table 4-8. OCP and Mercury Analytical Data Summary

Animal /a/	OCP (mg/kg)	Mercury (mg/kg)	Sample Count (Duplicate)		
			~1g Biopsy	~30g Tissue OCP	~ 30g Tissue Mercury
14BI934737	ND	ND	1 (1)	3 (1)	1 (1)
14BI380314	ND	0.023	1 (0)	3 (0)	1 (0)
14BI066551	ND	0.02	1 (0)	3 (0)	1 (1)
14BI382519	ND	0.02	1 (1)	3 (0)	1 (0)
14BI396272	0.021*	0.021	1 (0)	3 (3)	1 (0)
14BI438529	ND	0.026	1 (0)	3 (0)	1 (0)
14BI906520	ND	0.029	1 (1)	3 (0)	1 (1)
14BI076363	ND	0.02	1 (0)	3 (0)	1 (0)
14BI918427	ND	0.023	1 (0)	3 (0)	1 (0)
14BI065152	ND	0.023	1 (0)	3 (3)	1 (0)
14BI073062	ND	0.026	1 (0)	3 (2)	1 (0)
15BI0E0611	ND	NA**	1 (0)	3 (0)	0 (0)
14BI472764	ND	NA**	1 (0)	3 (0)	0 (0)
14BI028889	ND	ND	1 (0)	4 (0)	1 (1)
14BI075883	ND	ND	1 (0)	4 (1)	1 (0)
14BI080288	ND	ND	1 (0)	4 (1)	1 (0)
14BI089464	ND	ND	1 (0)	4 (1)	1 (0)
14BI913364	ND	ND	0 (0)	4 (1)	1 (0)
TOTALS:			17 (3)	59 (13)	16 (4)

/a/ Animal is identical to Site ID and equals [last two digits of year collected; “BI” for bison; and last six digits of an animal’s unique PIT chip]

*dieldrin in fat
** as a part of the fortuitous sampling protocol (see SAP 2.0 and SAP 2.5), kidney samples are not analyzed for mercury on fortuitous bison.

Table 4-9. Summary of Bison Demographic Data /a/ /b/

FIRST ROUNDUP - NECROPSY TISSUES						
PIT	Site ID /c/	Ear Tag	Birthyear	Sex	Biopsy	Necropsy
985121027934737	14BI934737	84swj3431	2012	female	yes (SWRI)	yes (ARDL)
985121021380314	14BI380314	84swj3404	2012	female	yes (SWRI)	yes (ARDL)
989002001066551	14BI066551	84swj3425	2012	female	yes (SWRI)	yes (ARDL)
985121021382519	14BI382519	84swj3433	2012	female	yes (SWRI)	yes (ARDL)
985121021396272	14BI396272	84swj3435	2012	female	yes (SWRI)	yes (ARDL)
985121021438529	14BI438529	84swj3421	2012	female	yes (SWRI)	yes (ARDL)
985121027906520	14BI906520	84swj3438	2011	male	yes (SWRI)	yes (ARDL)
985121028076363	14BI076363	84swj3418	2011	male	yes (SWRI)	yes (ARDL)
985121027918427	14BI918427	84swj3411	2011	female	yes (SWRI)	yes (ARDL)
985121028065152	14BI065152	84swj3413	2011	female	yes (SWRI)	yes (ARDL)
985121028073062	14BI073062	84swj3428	2011	female	yes (SWRI)	yes (ARDL)

FORTUITOUS SAMPLES						
PIT	Site ID /c/	Ear Tag	Birthyear	Sex	Biopsy	Necropsy
42110e0611	15BI0E0611	765	2004	female	no	yes (ARDL)
985120028472764	14BI472764	521	2005	female	no	yes (ARDL)

2ND ROUNDUP - BIOPSY AND NECROPSY TISSUES						
PIT	Site ID /c/	Ear Tag	Birthyear	Sex	Biopsy	Necropsy
989002001028889	14BI028889	84swj3403	2013	male	yes (ARDL)	yes (ARDL)
985121028075883	14BI075883	84swj3402	2013	male	yes (ARDL)	yes (ARDL)
985121028080288	14BI080288	84swj3416	2013	female	yes (ARDL)	yes (ARDL)
989002001089464	14BI089464	84swj3417	2013	male	yes (ARDL)	yes (ARDL)
985121027913364	14BI913364	none	2010	male	yes (ARDL)	yes (ARDL)

/a/ “Historical” samples were analyzed by SWRI and are not included in this DSR.
/b/ No fetal tissues were submitted for analysis.
/c/ Site ID equals [last two digits of year collected; “BI” for bison; and last six digits of an animal’s unique PIT chip]

APPENDIX A

Site ID	Field Sample Number	Sample Date	Analyte Concentration (µg/g) (LT = non detect result at reporting limit shown)														
			ACLDAN	ALDRN	CL6BZ	DLDRN	ENDRN	ENDRNK	GCLDAN	HG	HPCL	HPCLE	ISODR	OCLDAN	PPDDD	PPDDE	PPDDT
14BI065152																	
	15FA091	14-Jan-14	LT 0.05	LT 0.0126	LT 0.035	LT 0.012	LT 0.03	LT 0.039	LT 0.05		LT 0.05	LT 0.016	LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05
	15KI096	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15KI098	14-Jan-14								**0.023**							
	15LI094	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15MU092	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
14BI066551																	
	15FA049	14-Jan-14	LT 0.05	LT 0.0126	LT 0.035	LT 0.012	LT 0.03	LT 0.039	LT 0.05		LT 0.05	LT 0.016	LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05
	15KI052	14-Jan-14	LT 0.0048	LT 0.0024	LT 0.0048	LT 0.0024	LT 0.0048	LT 0.0048	LT 0.0048		LT 0.0048	LT 0.0012	LT 0.0024	LT 0.0048	LT 0.0048	LT 0.0048	LT 0.0048
	15KI053	14-Jan-14								**0.02**							
	15LI051	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15MU050	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
14BI073062																	
	15FA099	14-Jan-14	LT 0.05	LT 0.0126	LT 0.035	LT 0.012	LT 0.03	LT 0.039	LT 0.05		LT 0.05	LT 0.016	LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05
	15KI103	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15KI105	14-Jan-14								**0.026**							
	15LI101	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15MU100	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
14BI076363																	
	15FA081	14-Jan-14	LT 0.05	LT 0.0126	LT 0.035	LT 0.012	LT 0.03	LT 0.039	LT 0.05		LT 0.05	LT 0.016	LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05
	15KI084	14-Jan-14	LT 0.0048	LT 0.0024	LT 0.0048	LT 0.0024	LT 0.0048	LT 0.0048	LT 0.0048		LT 0.0048	LT 0.0012	LT 0.0024	LT 0.0048	LT 0.0048	LT 0.0048	LT 0.0048
	15KI085	14-Jan-14								LT 0.02							
	15LI083	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15MU082	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
14BI380314																	
	15FA044	14-Jan-14	LT 0.05	LT 0.0126	LT 0.035	LT 0.012	LT 0.03	LT 0.039	LT 0.05		LT 0.05	LT 0.016	LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05
	15KI046	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15KI048	14-Jan-14								**0.023**							
	15LI047	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15MU045	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
14BI382519																	
	15FA055	14-Jan-14	LT 0.05	LT 0.0126	LT 0.035	LT 0.012	LT 0.03	LT 0.039	LT 0.05		LT 0.05	LT 0.016	LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05
	15KI059	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15KI060	14-Jan-14								LT 0.02							
	15LI058	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15MU057	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
14BI396272																	
	15FA061	14-Jan-14	LT 0.05	LT 0.0126	LT 0.035	**0.021**	LT 0.03	LT 0.039	LT 0.05		LT 0.05	LT 0.016	LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05
	15KI066	14-Jan-14	LT 0.0044	LT 0.0022	LT 0.0044	LT 0.0022	LT 0.0044	LT 0.0044	LT 0.0044		LT 0.0044	LT 0.0011	LT 0.0022	LT 0.0044	LT 0.0044	LT 0.0044	LT 0.0044
	15KI068	14-Jan-14								**0.021**							
	15LI064	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15MU062	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
14BI438529																	
	15FA069	14-Jan-14	LT 0.05	LT 0.0126	LT 0.035	LT 0.012	LT 0.03	LT 0.039	LT 0.05		LT 0.05	LT 0.016	LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05
	15KI072	14-Jan-14	LT 0.006	LT 0.003	LT 0.006	LT 0.003	LT 0.006	LT 0.006	LT 0.006		LT 0.006	LT 0.0015	LT 0.003	LT 0.006	LT 0.006	LT 0.006	LT 0.006
	15KI073	14-Jan-14								**0.026**							
	15LI071	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15MU070	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004

Site ID	Field Sample Number	Sample Date	Analyte Concentration (µg/g) (LT = non detect result at reporting limit shown)														
			ACLDAN	ALDRN	CL6BZ	DLDRN	ENDRN	ENDRNK	GCLDAN	HG	HPCL	HPCLE	ISODR	OCLDAN	PPDDD	PPDDE	PPDDT
14BI472764																	
	15FA110	4-Sep-14	LT 0.05	LT 0.0126	LT 0.035	LT 0.012	LT 0.03	LT 0.039	LT 0.05		LT 0.05	LT 0.016	LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05
	15KI113	4-Sep-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15LI112	4-Sep-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15MU111	4-Sep-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
14BI906520																	
	15FA074	14-Jan-14	LT 0.05	LT 0.0126	LT 0.035	LT 0.012	LT 0.03	LT 0.039	LT 0.05		LT 0.05	LT 0.016	LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05
	15KI078	14-Jan-14	LT 0.0048	LT 0.0024	LT 0.0048	LT 0.0024	LT 0.0048	LT 0.0048	LT 0.0048		LT 0.0048	LT 0.0012	LT 0.0024	LT 0.0048	LT 0.0048	LT 0.0048	LT 0.0048
	15KI079	14-Jan-14								**0.029**							
	15LI077	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15MU076	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
14BI918427																	
	15FA086	14-Jan-14	LT 0.05	LT 0.0126	LT 0.035	LT 0.012	LT 0.03	LT 0.039	LT 0.05		LT 0.05	LT 0.016	LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05
	15KI089	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15KI090	14-Jan-14								**0.023**							
	15LI088	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15MU087	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
14BI934737																	
	15FA036	14-Jan-14	LT 0.05	LT 0.0126	LT 0.035	LT 0.012	LT 0.03	LT 0.039	LT 0.05		LT 0.05	LT 0.016	LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05
	15KI040	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15KI042	14-Jan-14								**0.028**							
	15LI041	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15MU038	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
15BI0E0611																	
	15FA106	6-Apr-15	LT 0.05	LT 0.0126	LT 0.035	LT 0.012	LT 0.03	LT 0.039	LT 0.05		LT 0.05	LT 0.016	LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05
	15KI109	6-Apr-15	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15LI108	6-Apr-15	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15MU107	6-Apr-15	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004		LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
14BI028889																	
	15FA001	9-Dec-14	LT 0.0382	LT 0.0097	LT 0.0267	LT 0.0092	LT 0.0229	LT 0.0298	LT 0.0382		LT 0.0382	LT 0.0122	LT 0.0382	LT 0.0382	LT 0.0382	LT 0.0382	LT 0.0382
	15FA002	10-Dec-14	LT 0.0347	LT 0.0088	LT 0.0243	LT 0.0083	LT 0.0208	LT 0.0271	LT 0.0347		LT 0.0347	LT 0.0111	LT 0.0347	LT 0.0347	LT 0.0347	LT 0.0347	LT 0.0347
	15KI004	10-Dec-14	LT 0.0030	LT 0.0015	LT 0.0030	LT 0.0015	LT 0.0030	LT 0.0030	LT 0.0030		LT 0.0030	LT 0.0008	LT 0.0015	LT 0.0030	LT 0.0030	LT 0.0030	LT 0.0030
	15KI006	10-Dec-14								LT 0.0131							
	15LI005	10-Dec-14	LT 0.0023	LT 0.0012	LT 0.0023	LT 0.0012	LT 0.0023	LT 0.0023	LT 0.0023		LT 0.0023	LT 0.0006	LT 0.0012	LT 0.0023	LT 0.0023	LT 0.0023	LT 0.0023
	15MU003	10-Dec-14	LT 0.0023	LT 0.0012	LT 0.0023	LT 0.0012	LT 0.0023	LT 0.0023	LT 0.0023		LT 0.0023	LT 0.0006	LT 0.0012	LT 0.0023	LT 0.0023	LT 0.0023	LT 0.0023
14BI075883																	
	15FA008	9-Dec-14	LT 0.0590	LT 0.0149	LT 0.0413	LT 0.0142	LT 0.0354	LT 0.0460	LT 0.0590		LT 0.0590	LT 0.0189	LT 0.0590	LT 0.0590	LT 0.0590	LT 0.0590	LT 0.0590
	15FA009	10-Dec-14	LT 0.0347	LT 0.0088	LT 0.0243	LT 0.0083	LT 0.0208	LT 0.0271	LT 0.0347		LT 0.0347	LT 0.0111	LT 0.0347	LT 0.0347	LT 0.0347	LT 0.0347	LT 0.0347
	15KI011	10-Dec-14	LT 0.0078	LT 0.0032	LT 0.0078	LT 0.0032	LT 0.0078	LT 0.0078	LT 0.0078		LT 0.0078	LT 0.0016	LT 0.0032	LT 0.0078	LT 0.0078	LT 0.0078	LT 0.0078
	15KI014	10-Dec-14								LT 0.0132							
	15LI012	10-Dec-14	LT 0.0032	LT 0.0016	LT 0.0032	LT 0.0016	LT 0.0032	LT 0.0032	LT 0.0032		LT 0.0032	LT 0.0008	LT 0.0016	LT 0.0032	LT 0.0032	LT 0.0032	LT 0.0032
	15MU010	10-Dec-14	LT 0.0023	LT 0.0012	LT 0.0023	LT 0.0012	LT 0.0023	LT 0.0023	LT 0.0023		LT 0.0023	LT 0.0006	LT 0.0012	LT 0.0023	LT 0.0023	LT 0.0023	LT 0.0023
14BI080288																	
	15FA015	9-Dec-14	LT 0.0486	LT 0.0122	LT 0.0340	LT 0.0117	LT 0.0292	LT 0.0379	LT 0.0486		LT 0.0486	LT 0.0156	LT 0.0486	LT 0.0486	LT 0.0486	LT 0.0486	LT 0.0486
	15FA016	10-Dec-14	LT 0.0347	LT 0.0088	LT 0.0243	LT 0.0083	LT 0.0208	LT 0.0271	LT 0.0347		LT 0.0347	LT 0.0111	LT 0.0347	LT 0.0347	LT 0.0347	LT 0.0347	LT 0.0347
	15KI020	10-Dec-14	LT 0.0028	LT 0.0014	LT 0.0028	LT 0.0014	LT 0.0028	LT 0.0028	LT 0.0028		LT 0.0028	LT 0.0007	LT 0.0014	LT 0.0028	LT 0.0028	LT 0.0028	LT 0.0028
	15KI021	10-Dec-14								LT 0.0135							
	15LI019	10-Dec-14	LT 0.0023	LT 0.0012	LT 0.0023	LT 0.0012	LT 0.0023	LT 0.0023	LT 0.0023		LT 0.0023	LT 0.0006	LT 0.0012	LT 0.0023	LT 0.0023	LT 0.0023	LT 0.0023
	15MU017	10-Dec-14	LT 0.0023	LT 0.0012	LT 0.0023	LT 0.0012	LT 0.0023	LT 0.0023	LT 0.0023		LT 0.0023	LT 0.0006	LT 0.0012	LT 0.0023	LT 0.0023	LT 0.0023	LT 0.0023

Site ID	Field Sample Number	Sample Date	Analyte Concentration (µg/g) (LT = non detect result at reporting limit shown)													
			ACLDAN	ALDRN	CL6BZ	DLDRN	ENDRN	ENDRNK	GCLDAN	HG	HPCL	HPCLE	ISODR	OCLDAN	PPDDD	PPDDE	PPDDT
14BI089464																	
	15FA022	9-Dec-14	LT 0.0347	LT 0.0088	LT 0.0243	LT 0.0083	LT 0.0208	LT 0.0271	LT 0.0347		LT 0.0347	LT 0.0111	LT 0.0347	LT 0.0347	LT 0.0347	LT 0.0347	LT 0.0347
	15FA023	10-Dec-14	LT 0.0347	LT 0.0088	LT 0.0243	LT 0.0083	LT 0.0208	LT 0.0271	LT 0.0347		LT 0.0347	LT 0.0111	LT 0.0347	LT 0.0347	LT 0.0347	LT 0.0347	LT 0.0347
	15KI027	10-Dec-14	LT 0.0023	LT 0.0011	LT 0.0023	LT 0.0011	LT 0.0023	LT 0.0023	LT 0.0023		LT 0.0023	LT 0.0005	LT 0.0011	LT 0.0023	LT 0.0023	LT 0.0023	LT 0.0023
	15KI028	10-Dec-14								LT 0.0138							
	15LI026	10-Dec-14	LT 0.0023	LT 0.0012	LT 0.0023	LT 0.0012	LT 0.0023	LT 0.0023	LT 0.0023		LT 0.0023	LT 0.0006	LT 0.0012	LT 0.0023	LT 0.0023	LT 0.0023	LT 0.0023
	15MU025	10-Dec-14	LT 0.0025	LT 0.0013	LT 0.0025	LT 0.0013	LT 0.0025	LT 0.0025	LT 0.0025		LT 0.0025	LT 0.0006	LT 0.0013	LT 0.0025	LT 0.0025	LT 0.0025	LT 0.0025
14BI913364																	
	15FA029	10-Dec-14	LT 0.0382	LT 0.0097	LT 0.0267	LT 0.0092	LT 0.0229	LT 0.0298	LT 0.0382		LT 0.0382	LT 0.0122	LT 0.0382	LT 0.0382	LT 0.0382	LT 0.0382	LT 0.0382
	15FA030	10-Dec-14	LT 0.0347	LT 0.0088	LT 0.0243	LT 0.0083	LT 0.0208	LT 0.0271	LT 0.0347		LT 0.0347	LT 0.0111	LT 0.0347	LT 0.0347	LT 0.0347	LT 0.0347	LT 0.0347
	15KI034	10-Dec-14	LT 0.0023	LT 0.0012	LT 0.0023	LT 0.0012	LT 0.0023	LT 0.0023	LT 0.0023		LT 0.0023	LT 0.0006	LT 0.0012	LT 0.0023	LT 0.0023	LT 0.0023	LT 0.0023
	15KI035	10-Dec-14								LT 0.0128							
	15LI032	10-Dec-14	LT 0.0023	LT 0.0012	LT 0.0023	LT 0.0012	LT 0.0023	LT 0.0023	LT 0.0023		LT 0.0023	LT 0.0006	LT 0.0012	LT 0.0023	LT 0.0023	LT 0.0023	LT 0.0023
	15MU031	10-Dec-14	LT 0.0025	LT 0.0013	LT 0.0025	LT 0.0013	LT 0.0025	LT 0.0025	LT 0.0025		LT 0.0025	LT 0.0006	LT 0.0013	LT 0.0025	LT 0.0025	LT 0.0025	LT 0.0025

Notes:
FA = Fat
KI = Kidney
LI = Liver
MU = Muscle

APPENDIX B

Site ID	Field Sample Number	Flag Code	Sample Date	Analyte Concentration (ug/g) (LT = non detect result at reporting limit shown)													
				ACLDAN	ALDRN	CL6BZ	DLDRN	ENDRN	ENDRNK	GCLDAN	HPCL	HPCLE	ISODR	OCLDAN	PPDDD	PPDDE	PPDDT
14BI065152																	
	15KI097	D	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15LI095	D	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15MU093	D	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
14BI073062																	
	15KI104	D	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15LI102	D	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
14BI075883																	
	15KI013	D	14-Jan-14	LT 0.010	LT 0.005	LT 0.010	LT 0.005	LT 0.010	LT 0.010	LT 0.010	LT 0.010	LT 0.002	LT 0.005	LT 0.010	LT 0.010	LT 0.010	LT 0.010
14BI080288																	
	15MU018	D	10-Dec-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
14BI089464																	
	15FA024	D	10-Dec-14	LT 0.050	LT 0.013	LT 0.035	LT 0.012	LT 0.030	LT 0.039	LT 0.050	LT 0.050	LT 0.016	LT 0.050	LT 0.050	LT 0.050	LT 0.050	LT 0.050
14BI382519																	
	15FA056	D	14-Jan-14	LT 0.050	LT 0.013	LT 0.035	LT 0.012	LT 0.030	LT 0.039	LT 0.050	LT 0.050	LT 0.016	LT 0.050	LT 0.050	LT 0.050	LT 0.050	LT 0.050
14BI396272																	
	15KI067	D	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15LI065	D	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
	15MU063	D	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
14BI906520																	
	15FA075	D	14-Jan-14	LT 0.050	LT 0.013	LT 0.035	LT 0.012	LT 0.030	LT 0.039	LT 0.050	LT 0.050	LT 0.016	LT 0.050	LT 0.050	LT 0.050	LT 0.050	LT 0.050
14BI913364																	
	15LI033	D	10-Dec-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004
14BI934737																	
	15FA037	D	14-Jan-14	LT 0.050	LT 0.013	LT 0.035	LT 0.012	LT 0.030	LT 0.039	LT 0.050	LT 0.050	LT 0.016	LT 0.050	LT 0.050	LT 0.050	LT 0.050	LT 0.050
	15MU039	D	14-Jan-14	LT 0.004	LT 0.002	LT 0.004	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004	LT 0.001	LT 0.002	LT 0.004	LT 0.004	LT 0.004	LT 0.004

APPENDIX C – RESPONSE TO COMMENTS (EPA)

**TECHNICAL COMMENTS ON THE
BISON TISSUE CONTAMINANT STUDY, DATA SUMMARY REPORT, REVISION B
ROCKY MOUNTAIN ARSENAL, COMMERCE CITY, COLORADO
February 22, 2016**

GENERAL COMMENTS

1. The *Bison Tissue Contaminant Study Data Summary Report* (DSR) appears to confuse terminology regarding evaluation of data quality objectives (DQOs) with reviewing sample data for quality to determine whether it is usable/defensible. The purpose of the DSR is to, "summarize the analytical results and to determine data usability" (USFWS 2014). The DSR should be corrected/revised to provide the quality review of the data as identified in Section 8 of Sampling and Analysis Plan (SAP) 2 and SAP 2.5 rather than refer to evaluation of DQOs (USWS 2014)(USFWS 2015). Evaluation of DQOs takes place after the data quality review and after the data is determined to be of acceptable quality, defensible, and suitable for decision making. Evaluation of DQOs is more involved and will include risk calculations and data evaluation (e.g., as identified in Section 4.1 of SAP 2). Evaluation of DQOs is to be documented in a separate "evaluation" report (reference Section 10.3 of SAP 2) (USFWS 2015).

   Comment noted, but no specific changes are required to the DSR.

2. The DSR addresses adjustment of data for fat content. However, this evaluation is inappropriate for the DSR. Further, a Regulatory Agency-approved method for evaluating fat content has not been determined. Because the purpose of the DSR is to report data and describe the quality control review of the data, the document should be revised to simply report the sample numbers that were analyzed for fat content, and the fat concentrations determined by the laboratory.

   Discussion and reference to the National Bison Association deleted from this DSR.

3. Section 3.0 states that the DSR summarizes data collected over the past 8 years (2007 to 2015). However, the information in the DSR does not appear to cover this time-span and also appears to be internally inconsistent. For example:

   - Section 3.1 of the DSR describes samples collected in December 2013, January 2014, and December 2014.
   - Appendix A includes analytical data for January 2014, September 2014, December 2014, and April 2015.

   Additional clarification was added. This DSR only includes samples collected under SAP 2.0 and SAP 2.5. A table was also added (Table 3-1) comparing collection dates and analysis.

   SAPs 2.0 and 2.5 also describe various sampling events:

   - SAP 2, Section 3.0 describes sampling events conducted in January 2014, November 2014 **(**from a bison euthanized in the field), and December 2014 (USFWS 2015).
   - SAP 2, Section 5.1.1 identifies necropsy sampling events in January 2014, December 2014, and April 2015 (bison euthanized after being injured from a vehicle) (USFWS 2015).

- Section 1.2 of SAP 2.0 and 2.5 describes collection of tail bulb fat samples and necropsy samples in December 2013 and necropsy samples in January 2014 (n=68 plus fetal tissue where applicable) (USFWS 2014)(USFWS 2015).

Please revise the DSR for internal consistency.

The "November 2014" fortuitous bison has created some confusion. There was a different animal discovered dead during this timeframe, but the actual animal euthanized and sampled was in September 2014. This error has been corrected in the DSR text. The actual sample dates associated with samples collected are correct in Appendix A.

4. Supplemental information is needed to understand the data provided in Table 4-8 and Appendix A. Please identify: sampling method (necropsy, live tail bulb biopsy, other), sample size, date analyzed, laboratory, laboratory method, laboratory reporting limits, identify whether any of the data was from fetal tissue, identify the corresponding analytical lot, and identify which data (if any) were qualified (by the laboratory or in the verification/validation process). SAP 2.0 requires lipid analysis for each sample when possible. Include the corresponding lipid analysis. Additionally, please provide the raw data from the laboratories on a Compact Disk.

The following additional information was added to Table 4-8 (sampling method, laboratory, and whether or not fetal tissue was analyzed). Sample size, date analyzed, and laboratory method is included in Appendix A. The USFWS does not have any compact disks or computers that can create a compact disk. If necessary, please coordinate on how to best obtain raw data.

SPECIFIC COMMENTS

5. **Section 2.2, Page 7.** This section states that organochlorine pesticides are the principal contaminants of concern on the Rocky Mountain Arsenal (RMA) National Wildlife Refuge (NWR) and cites "USFWS 2013b." However, a reference for this citation is not provided. Please provide the reference for this statement.

Citation was added to References.

6. **Section 3.0, Page 9.** This section states, "This DSR summarizes bison tissue contaminant data collected over the past 8 years (2007 – 2015) from three four phases of sample collection." The statement should be corrected to identify the number of sampling phases and as stated in the General Comments, the data presented in the DSR and the timeframe for sampling should be revised to be consistent.

Corrected. The intention of this statement was to include the time from when bison were reintroduced to the Refuge. However, the range of samples collected was between 2008 and 2015. Regardless, this DSR only covers samples collected under SAP 2.0 and SAP 2.5 and does not include these "historical" samples.

7. **Section 3.1, Page 9.** This section refers to sample collection and describes when bison samples were collected. The following are comments on this section:

   a. This section does not describe how samples were collected. The actual sample collection methods should be described, in comparison with the sampling procedures identified in the SAPs, to identify compliance and deviations from the collection requirements and an explanation for any deviations.

b. Bullet 2 indicates that the January 2014 necropsy samples were collected under SAP 2.0. However, because work on SAP 2.0 did not begin until July 2014 and Revision H of the SAP is dated April 2015, this statement is confusing. This statement should be clarified. It is understood that the samples collected in January 2014 were collected without a Regulatory Agency-approved SAP and that the collected tissue samples were frozen and held for analysis until after the protocol identified in SAP 2.0 was developed. Please clarify

c. Bullet 3 refers to "tail head biopsy" sampling in December 2014. However, SAPs 2.0 and 2.5 refer to tail bulb biopsy rather than tail head. Please clarify.

Text was added to describe the two tissue collections plans used between January 2014 and April 2015. A footnote was added stating that "tail-head" is the correct term.

8. **Section 3.2, Page 10.** This section explains that samples were analyzed for contaminants of potential concern (COPCs) identified during the Integrated Endangerment Assessment/Risk Characterization (IEA/RC) as well as additional target analytes identified by the Regulatory Agencies. The IEA/RC identified a larger list of analytes than those included in SAP 2 and SAP 2.5, for different media, so this reference is overly vague. It is also inconsistent with the analyte selection summary provided in the SAPs. In addition, more information is needed to explain how the Regulatory Agencies identified additional COPCs. For clarity and consistency with SAP 2 and 2.5, this discussion should be revised to be consistent with the discussion in Section 4.2 and Section 5.2 of these SAPS respectively (USFWS 2015)(USFWS 2014) and should explain that the additional target analytes were identified by the Regulatory Agencies based on a review conducted in 2014 of RMA contaminants against current persistence, bioaccumulation, and toxicity criteria (EPA 2012).

Text from SAP 2.0 was inserted into the document to provide verbatim explanation.

In addition, this section explains that samples from SAP 1 were analyzed to evaluate the dieldrin concentrations against the Food and Drug Administration (FDA) action level in fat. However, SAP 1 states, "The purpose of this Sampling and Analysis Plan (SAP) is to demonstrate that dieldrin concentrations in bison tissue from the Rocky Mountain Arsenal National Wildlife Refuge (Refuge) are below the United States Department of Agriculture (USDA) action level of 300 parts per billion (ppb)" (USFWS 2013). No reference to the FDA can be found in SAP 1. Please correct this section appropriately. In addition, a statement should be included in this section clarifying that the Regulatory Agencies did not concur with the scope or content of SAP 1 and the work identified in this SAP was conducted solely by the USFWS for their own information.

A footnote was added. Text corrected to reflect USDA versus FDA.

9. **Section 3.2, Page 11, Paragraph 1.** This paragraph explains that multiple detection limits have been used for the Bison Tissue Contaminant Study (BTCS). However only the detection limits identified in SAP 2.0 and SAP 2.5 are provided in the DSR (Table 4.2). The DSR should identify all of the analytical detections limits used throughout the program and provide reference to the SAP from which they came (or note if the detection limits were not defined in any SAP). Also, it would useful to indicate if the SAP was approved by the Regulatory Agencies.

This text was deleted to avoid confusion. Only samples collected under SAP 2.0 and SAP 2.5 are included in this DSR. Detection limits did not change between these SAPs. The DSR includes appropriate footnotes indicating where Regulatory Agency approval applies.

10. **Section 3.2, Page 11, Paragraph 4.** This paragraph states that all samples were analyzed for organochlorine pesticides (OCPs). However, samples collected during the first two sampling events were analyzed for a different suite of OCPs than the third event. The DSR should include a table that lists the specific chemicals analyzed during each sampling event.

    A footnote was added to a new table describing sampling collection dates, sampling plan, and laboratory used for analysis. Only samples collected under SAP 2.0 and SAP 2.5 are included in this DSR. OCP methods did not change between these SAPs.

    In addition, this paragraph states that samples were analyzed for lipid content except where there was insufficient sample size. A table should be provided identifying specifically which samples were/were not analyzed for lipid content. Appendix A should include the results of the lipid analysis.

    Lipid content was not measured in tissues for SAP 2.0 and SAP 2.5. The purpose of collecting these lipid measurements is unclear, but failure to measure lipid content in tissues does not materially affect data usability.

11. **Section 4.0, Pages 10 and 11.** This section states, "Since only samples from SAP 2.0 and SAP 2.5 had detection limits sufficiently low to compare to risk-based TSLs [tissue screening levels], only QC [quality control] associated with these samples will be evaluated." This statement is confusing for several reasons and should be removed or significantly revised. The following are examples of specific issues with this statement:

    a. As stated in previous comments from the Regulatory Agencies, it is not appropriate to compare data to risk-based TSLs for evaluation of potential consumption risk. Further, it is not clear why comparison to risk-based TSLs is relevant to review of QC data.

        As mentioned in your first comment, "The purpose of the DSR is to, 'summarize the analytical results and to determine data usability' and these levels are used to determine the adequacy of data."

    b. A data quality review is necessary for all data that is anticipated to be used for decision making and for eventual evaluation of DQOs. If the data from the first sampling event are not evaluated for data quality (including a review of QC data), then that data should not be used in the BTCS. It is recommended that the DSR be revised to provide a data quality review for all data collected that is desired to be used in decision making in the BTCS.

        Data from SWRI is not included in this DSR.

12. **Section 4.0, Page 11.** This section states that laboratory control spike recovery was designed at 25 to 125 percent for laboratory control spikes in the SAPs. However, this range cannot be specifically identified in either SAP 2 or 2.5. Please check the referenced range.

    25 to 125 percent was the range utilized by the laboratory for recovery.

13. **Section 4.0, Page 13.** The following are comments on the subsection titled "Data Evaluation."

    a. The term "human health SSRBSSLs" is not defined in any of the SAPs. This term should be defined or corrected. Also, it appears that there may be a typographical error in the acronym.

        Corrected.

b. The first sentence of this section explains that the sample results were evaluated to determine whether any contaminant concentrations exceeded the "human health SSRBSSLs" identified in SAP 2.0 and SAP 2.5. It is not clear why this comparison is being conducted. As stated in previous comments from the EPA, the purpose of establishing the site-specific risk-based screening levels (SSRBSLs) to identify appropriate laboratory reporting limits, not to evaluate risk. Also, the discussion following this statement only refers to comparison of the data to the reporting limits, so the relevance of this statement to the following discussion is not clear. It is recommended that this statement be deleted.

As mentioned in your first comment, "The purpose of the DSR is to, 'summarize the analytical results and to determine data usability' and these levels are used to determine the adequacy of data."

c. The second paragraph discusses fat-adjusted evaluation of the data. However, adjustment of data based on fat content is not a component of the SAPs and is not an approach that has been approved by the Regulatory Agencies. Further, the purpose of the DSR is only to report the data and provide a data quality review to determine if the data is suitable for decision making. Discussion of fat-adjustment should be removed from the DSR and subsequent documents.

Discussion and reference to the National Bison Association deleted from this DSR.

14. **Section 5.0, Page 13.** This section states, "The DQOs were evaluated using all data collected for SAP 2.0 and SAP 2.5 and it was determine that all project DQOs for Phase 2 were met." However this DSR has not evaluated the DQOs of SAP 2.0, which require risk calculations. The purpose of DSRs is not to evaluate DQOs, but to report data that has been collected and to provide a quality review of the data to determine if any of the data should be qualified or rejected and ultimately to determine if it is of suitable quality to be used in decision making. The evaluation report will (e.g., referenced in Section 10.3 of SAP 2.0) will evaluate the DQOs. The summary should be revised appropriately.

    In addition, it is noted that the Data Evaluation Report will need to evaluate the DQOs in a step-wise manner, as identified in the SAP(s). It will not be appropriate to simply state that all DQOs were met, as stated in the DSR. This statement is deficient in its depth and breadth of analysis, and importantly, it NOT in agreement with the DQOs.

    Text deleted from this DSR.

15. **Table 4-1, Page 18.** This table identifies the final COPCs. It is understood that the COPCs listed on this table were not included in analyses for all of the different sampling events. The table should be revised, or another table included, that lists the analytes for each sampling event.

    A footnote was added that isodrin, hexachlorobenzene, and mercury were added to the COPC list for SAP 2.0 and SAP 2.5.

16. **Table 4-2, Page 19.** This table identifies the laboratory method detection limits in comparison to the SSRBSLs. It appears that this table only provides the method detection limits for samples analyzed by Applied Research and Development, Inc. (ARDL). Section 3.2 explains that two laboratories analyzed the bison tissue samples: Southwest Research Institute and ARDL. For completeness, and to understand the full data set, detection limits should be provided for samples analyzed by each of the laboratories and the associated SAP and SAP-defined detection limits should be identified.

Data from SWRI is not included in this DSR.

17. **Table 4-3, Page 20.** This table lists results of duplicate sample analysis. Duplicate data is only provided for mercury. This information appears to be the laboratory duplicate data as described in Section 8.5.1 of SAP 2.5 (i.e., laboratory duplicates will be analyzed for inorganics only) (USFWS 2014). Please clarify. Section 4.0 of the DSR states that a total of 15 duplicate analyses were evaluated for OCPs and the results were all below the reporting limit. A more complete summary of the actual samples submitted for duplicate analysis should be provided. The DSR should also clarify which samples were field duplicates versus laboratory duplicates.

    A table (Table 4-3) was added for OCP duplicates. Field versus laboratory duplicates do not apply to biological samples.

18. **Table 4-4 Page 21 and Table 4-5, Pages 22 through 25.** These tables report laboratory control spike percent recoveries. Some of the percent recoveries are outside of the limits of 80 – 130 percent that is identified in Section 8.4.2 of SAP 2 and 70 to 130 percent identified in Section 8.5.2 of SAP 2.5 (USFWS 2015)(USFWS 2014). An explanation of low laboratory control spike recoveries should be provided. Because laboratory control spikes are used to measure laboratory accuracy, the DSR should also explain whether any of the data associated with these sample lots should be qualified (per Section 8.4.2 of SAP 2 and Section 8.5.2 of SAP 2.5).

    The laboratory utilized a range of 25 to 125 percent for recovery. There is no reason to believe this range affects the accuracy of data provided.

19. **Table 4-4 Page 21 and Table 4-6, Pages 26 through 28.** These tables report matrix spike recoveries. Recovery limits established in SAP 2 and SAP 2.5 are 80 percent to 130 percent until the laboratory established method/analyte-specific ranges. Explain whether a recovery range has been established by the laboratory and flag samples that are outside of the required recovery range. Several of the percent recoveries are outside the 80 to 130 percent range. The DSR should explain whether the data associated with these sample lots should be qualified because of matrix interferences. In addition, the meaning of the negative investigate data values should be described.

    The laboratory utilized a range of 25 to 125 percent for recovery. There is no reason to believe this range affects the accuracy of data provided. The investigative value represents the total analyte concentration in the matrix sample. This includes the spike plus any original concentration and would generally be negative when recovery is below 100%. Such negative matrix interference is not sufficient to qualify results.

20. **Table 4-7, Page 29.** This table summarizes OCP and mercury data. The following are comments on this table:

    a. The table identifies "ND" which is understood to represent nondetections. However, for this information to be meaningful, the detection limit is needed. The table should be revised to replace ND with the highest detection limit or a range of detection limits.

        There are multiple analytes and therefore multiple detection limits. For ease, this table shows that all but one bison are less than detection for all analytes. A new Appendix B was developed with data and detection limits for all analytes.

b. It is understood that these values are provided for different bison. Please provide a note on the table explaining the numbers in the "Animal" column and explaining what tissue the data represent. It is not clear why data from all of the tissues sampled was not presented (along with the associated detection limits).

Table 4-9 was added to assist with animal identification. Appendix A contains all information. This table is a summary showing that all but one tissue (fat) was nondetect for OCPs. Mercury detections are shown for kidney samples.

c. Provide a note explaining why mercury data was "NA" for two of the bison.

A note has been added to the table explaining that kidney samples from fortuitous bison are not analyzed for mercury.

References

U.S. Environmental Protection Agency (EPA). 2012. Persistent, Bioaccumulative, and Toxic Profiles Estimated for Organic Chemicals. *Ver 2.000.* http://www.pbtprofiler.net/. Last Updated September 4.

U.S. Fish and Wildlife Service (USFWS). 2013. *Rocky Mountain Arsenal National Wildlife Refuge, Sampling and Analysis Plan, Bison Pesticide Residue Study*. Revision L. December 16.

USFWS. 2014. *Rocky Mountain Arsenal National Wildlife Refuge, Bison Tail Bulb Biopsy and Tissue Necropsy Sampling and Analysis Plan, Bison Tissue Contaminant Study*. Revision D. December 8.

USFWS. 2015. *Rocky Mountain Arsenal National Wildlife Refuge, Sampling and Analysis Plan, Analysis of Tissue and Tail Bulb Fat, 2014 Necropsy Samples (SAP No. 2), Bison Tissue Contaminant Study*. Revision H. April 30.

APPENDIX D – RESPONSE TO COMMENTS (CDPHE)

COLORADO
Department of Public Health & Environment

March 11, 2016

Ms. Roberta Ober
Office of the Program Manager
Rocky Mountain Arsenal
ATTN: IMCR-AR, Building 129
6550 Gateway Road
Commerce City, Colorado 80022-1748

RE: CDPHE Comments to Draft Bison Tissue Contaminant Study, Data Summary Report (DSR), Revision B

Dear Ms. Ober,

The Colorado Department of Public Health and Environment (CDPHE) has received and reviewed "Bison Tissue Contaminant Study, Data Summary Report (DSR), Revision B" dated February 2016. Our comments are attached.

Please contact me at (303) 692-3321 or susan.newton@state.co.us if you have any questions.

Sincerely,

Susan Kay Newton
Rocky Mountain Arsenal Project Manager
Restoration and Remediation Unit

CC: Greg Hargreaves, EPA (2 copies)
Bruce Hastings, USFWS
Trevor Klotz, Sentinel Consulting
RMA File #10.17
Raj Goyal, CDPHE
David Banas, AGO
Deanne Kelly, TCHD
Weslyn Erickson, RVO
Kelly Cable, Shell Oil

Colorado Department of Public Health and Environment's (CDPHE) Comments on Bison Tissue Contaminant Study, Data Summary Report (DSR), Revision B Rocky Mountain Arsenal February 11, 2016

General Comments

1. The Colorado Department of Public Health and the Environment (CDPHE) has completed our review of the Bison Tissue Contaminant Study Data Summary Report (DSR), Revision B, dated February 11, 2016. The stated purpose of a DSR is to summarize analytical results and present an evaluation of data usability. As written, the DSR does not accurately define the data being evaluated, nor does the DSR provide suitable justification for data usability. For example, several of the sample results had detection limits, above the Site-Specific Risk-Based Screening Levels, yet these sample results have not been specifically identified or discussed. The following comments are provided for clarity.

   Comment noted, but no specific changes are required to the DSR from this general comment.

Specific Comments

2. Section 1.0, page 6, second paragraph - According to this section, there were three main objectives for the Bison Tissue Contaminant Study (BTCS). The Division recommends that this paragraph be revised to re-state the two main objectives detailed in Section 3.0 of the Bison Tissue Contaminant Study Sampling and Analysis Plan (SAP 2). In other words, this section should state that the purpose for data collection is: (1) to obtain data that will be adequate to quantify any potential human cancer and non-cancer risks from ingestion of bison raised on RMA National Wildlife Refuge; and (2) determine if necropsy tail bulb fat collected in 2014 is predictive of any risk from ingestion of bison tissue.

   Text from SAP 2.0 was inserted into the document to provide verbatim explanation.

3. Section 3.0, page 9 – According to this section, the DSR is intended to summarize *"bison tissue contaminant data collected over the past 8 years (2007-2015) from three four* (sic) *phases of sample collection."* Technically, this DSR should only summarize analytical results, including the assessment of data usability, for data *analyzed* under SAP 2, including samples collected under the Bison Tail Bulb Biopsy and Tissue Necropsy Bison Tissue Contaminant Study (SAP 2.5). The introduction or discussion of data collected as part of the independently implemented USDA Study is confusing and irrelevant for the purposes of this DSR. Please revise this section, as appropriate, to accurately define the data covered by this DSR. This DSR should clearly define the applicable data sets (SAP 2.0 and SAP 2.5), summarize those analytical results, and determine data usability based on SAP objectives.

Corrected. The intention of this statement was to include the time from when bison were reintroduced to the Refuge. However, the range of samples collected was between 2008 and 2015. Regardless, this DSR only covers samples collected under SAP 2.0 and SAP 2.5 and does not include these "historical" samples.

4. Section 4.0, page 12, Data Evaluation – The Division has the following comments on this section:
   a. The data evaluation presented in this section, in relation to Site Specific Risk-Based Screening Levels (SSRBSLs), is not necessarily consistent with the purpose of this DSR. Per section 6.1 of SAP 2.0, SSRBSLs were calculated to identify applicable laboratory detection/reporting limits, not to determine/evaluate potential risk. For the purposes of this DSR, it is appropriate to compare the individual analytical detection limits against the stated SSRBSLs, as a means to determine data usability. Please update this evaluation to include an evaluation of detection limits for each sample.
   b. According to Table 4-4, several of the laboratory control spike percent recoveries were outside the SAP specified ranges. Please add a discussion to this section about any impact on data usability due to these recoveries (see SAP 2.0, section 8.4.2).
   c. Please add a discussion regarding usability of data as it relates to matrix interferences.

As mentioned in your first comment, "The purpose of the DSR is to, 'summarize the analytical results and to determine data usability' and these levels are used to determine the adequacy of data." The laboratory utilized a range of 25 to 125 percent for recovery. There is no reason to believe this range affects the accuracy of data provided.

5. Section 5.0, page 13 - The Division has the following comments on this section:
   a. When comparing against risk based screening levels, the DSR should only look at usability of the data based on the applicable detection limits. In other words, if the detection limit for a particular sample/analyte was above the corresponding RBSL, then the data would be less useful for future evaluations. Any potential limitations of the data should be discussed in this DSR.
   b. The DSR should not evaluate the SAP Data Quality Objectives. The DSR should only summarize the analytical results and evaluate usability of the data. Per SAP 2.0, a *Bison Tissue Necropsy and Tail Bulb Evaluation Report* will be produced to assess and evaluate the data presented in this DSR, in regard to the Data Quality Objectives.

Text deleted from this DSR.

6. Table 4-3, Page 20 – This table lists the four duplicate mercury samples that were evaluated/analyzed as part of this DSR. While it is understood that OCP duplicates were below the analytical reporting limits, please provide a comparable table for the 15 OCP duplicate analyses (discussed on page 11). This table should include the applicable reporting limits.

A table (Table 4-3) and new appendix (Appendix B) were added for OCP duplicates. All OCP samples were non-detect and reporting limits can be found in Appendix A.

7. Table 4-7, page 29 - This table presents a summary of OCP and Mercury data results. The Division has the following comments:
    a. Please add the applicable analytical detection limit for each sample.
    b. In addition to the Summary of Bison Demographic Data, please provide a key for the site ID regarding the tissue type, and sample size.

    Reporting limits can be found in Appendix A. A footnote was added to all tables explaining site ID. A new summary of samples collected (and duplicates) by animal was added to Table 4-8.

8. Appendix A – Appendix A reportedly contains the analytical results for all samples collected under this DSR. The Division has the following comments:
    a. As discussed above, please provide a key for the animal/sample ID. This key should include information regarding tissue type, and sample size.
    b. Please include sample specific lipid content results (See SAP 2.0, section 6.2).

    A footnote was added to all tables explaining site ID. A new summary of samples collected (and duplicates) by animal was added to Table 4-8. Lipid content was not measured in tissues for SAP 2.0 and SAP 2.5. The purpose of collecting these lipid measurements is unclear, but failure to measure lipid content in tissues does not materially affect data usability.

APPENDIX E – RESPONSE TO COMMENTS (Tri-County Health Department)

Tri-County Health Department

March 24, 2016

Roberta Ober
Office of the Program Manager
Rocky Mountain Arsenal
AMXRM-PM, Bldg. 129
Commerce City, CO 80022-1748

RE: TCHD comments to Bison Tissue Contaminant Study Data Summary Report (Revision B)

Dear Ms. Ober,

Tri-County Health Department has received and reviewed the above referenced document. We have no questions or comments at this time.

Please contact me at (303) 439-5909 or dkelly@tchd.org if you have any questions.

Sincerely,

Deanne Kelly

Deanne Kelly, R.E.H.S., S.C.
Rocky Mountain Arsenal Field Supervisor

Cc: David Lucas, USFWS
Greg Hargreaves, EPA
Susan Newton, CDPHE
Kelly Cable, Shell Oil
Bruce Hastings, USFWS
TCHD File