Permit 3/19/10

ENTERED

STATE OF NEW MEXICO
BEFORE THE SECRETARY OF ENVIRONMENT

IN THE MATTER OF:	)	
	)	
APPLICATION OF THE UNITED STATES DEPARTMENT OF ENERGY AND LOS ALAMOS NATIONAL SECURITY LLC FOR A HAZARDOUS WASTE FACILITY PERMIT FOR LOS ALAMOS NATIONAL LABORATORY, and the NOTICE OF INTENT TO DENY A PERMIT FOR OPEN BURN UNITS TA-16-388 AND TA-16-399 FOR LOS ALAMOS NATIONAL LABORATORY.	)	**Nos. HWB 09-37 (P)** **HWB 10-04 (P)** **Consolidated**

MAR 2010
DOCKETED BY THE HEARING CLERK BEFORE THE SECRETARY OF ENVIRONMENT

WRITTEN TESTIMONY OF PAIGE WALTON

My name is Paige Walton. I am a Senior Scientist and Program Manager with AQS, Inc., an independent environmental consulting company. I am presenting this written testimony on behalf of the New Mexico Environment Department (the Department) in the hearing concerning the issuance of a renewal permit for storage and treatment of hazardous waste at Los Alamos National Laboratory (LANL), and the denial of a permit to treat hazardous waste at open burn units at LANL. This testimony is marked as **NMED Exhibit 174.**

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I. BACKGROUND AND EXPERIENCE

While my original area of education was geology and I retain certification as a Professional Geologist in Utah, I entered into the field of risk assessment and toxicology during graduate school. My research focused on the toxicology and mitigation of effects of acid mine drainage on aquatic species. I have subsequently worked as an environmental consultant for over 16 years, providing technical support for Resource Conservation and Recovery Act (RCRA) permits, corrective action investigations, and human health and ecological risk assessments. I have written and/or reviewed over 300 human health and ecological risk assessments, including those for chemical, radiological, and mixed waste sites. Human receptors have included residents, various types of on-site industrial workers, construction workers, recreational purposes, and specialty receptors to include subsistence farmers, fishers, and hunters. Ecological receptors have included both protected and non-protected terrestrial, avian, and aquatic specifies. I have developed and reviewed risk assessment guidance for State and Federal programs, developed soil and groundwater screening levels for States and territories (such as Puerto Rico), and conducted numerous risk assessment workshops and training classes. Clients have included federal regulatory agencies, state regulatory agencies, federal facilities and private industry. I am current in my understanding of the risk assessment arena, and continually educate myself by staying abreast of new guidance, trends, position papers, and studies. A copy of my vita is **NMED Exhibit 175**. It is accurate and up-to-date.

II. SUMMARY

This first part of my testimony provides the basis for the requirements included in Part 11 (Corrective Action) Sections 11.10.4 through 11.10.6 of the Proposed Permit, dated February 2, 2010. The second part of my testimony discusses my technical review and assessment of the application to permit the Technical Area 16 (TA-16) open burning units and the basis for the Department's Notice of Intent to Deny this application based on uncertainties associated with the ecological risk assessment.

III. PERMIT CONDITIONS

Sections 11.10.4 (Site-Specific Human Health Risk Assessment), 11.10.5 (Site-Specific Ecological Risk Assessment), and 11.10.6 (Determination of Background) of the Proposed Permit, dated February 2, 2010, are consistent with applicable Federal and State guidance for conducting human health and ecological risk assessments.

The initial step of the risk assessment process is to conduct a screening level assessment. The screening level assessment includes the comparison of site data to conservative, standardized screening levels, such as those contained in the New Mexico Soil Screening Guidance (NMED 2009) (NMED Ex. 136) and the U.S. Environmental Protection Agency (EPA) Regional Screening Levels (USEPA 2009). In the event that the screening assessment indicates elevated risk, a more refined, site-specific risk assessment may be required. The processes outlined in the permit conditions discussed below follow standardized approaches for risk assessment.

Risk assessments are tools used to evaluate the type and magnitude of risk to receptors from chemical contaminants present in environmental media, such as soil or

groundwater. The process for conducting risk assessment is based upon generalized equations using either standard or site-specific input data. The results of the assessment may be used to assess contamination levels to see if corrective action is required or to evaluate the effectiveness of a remedy.

Permit Section 11.10.4.1, Human Health Risk Assessment Methods, outlines the requirements of the conceptual site model. A conceptual site model is an industry standard tool used to: 1) identify the sources of contamination (*e.g.*, soil, groundwater, and/or air); 2) show how contamination may be released to and migrate through various environmental media (*e.g.*, migrate from soil into groundwater or volatilize from soil into air); 3) identify human receptors (*e.g.*, resident, on-site worker, and/or recreationalist) that may come into contact with potentially impacted media; and 4) identify potential exposure pathways (*e.g.*, ingestion of soil, inhalation of particles, and/or dermal contact with soil). The conceptual site model is a representation (typically in graphical form) of the conditions at the site at the time of the investigation. The purpose of the conceptual site model is to provide an overview of where contamination is located, how it moves through the environment and how receptors may become exposed. (**NMED Exhibit 178 (AR 33124)**, **AR 13451**, NMED Ex. 135, and NMED Ex. 136)

Permit Section 11.10.4.1.i, Exposure Pathways, addresses how, as part of the conceptual site model, exposure pathways are evaluated as being complete or incomplete. An exposure pathway is how a chemical goes from its source (*e.g.*, soil) or secondary sources (*e.g.*, contaminants migrating from soil into groundwater) and how receptors can come into contact with, or be exposed, to the chemical. An exposure pathway has several elements: 1) source of contamination, 2) a transport mechanism or way the chemical can

be mobilized from the source, 3) an exposure point such as a drinking water well, 4) a way to come into contact with the chemical or route of exposure (*e.g.,* eating, inhalation), and 5) someone who is or could hypothetically be exposed. When all these components are present, the exposure pathway is deemed complete. In a risk assessment, only complete exposure pathways are evaluated. (**AR 32068,** NMED Ex. 135, NMED Ex. 136)

Permit Section 11.10.4.1.ii, Data Quality Assurance, addresses means to assure sufficient data quality. It is important that data used in the risk assessment are of sufficient quantity and quality (as outlined in permit condition 11.10.3). When comparing site data to screening levels or other performance standards, it is important to ensure that the analytical methods used in the laboratory will produce data that are sensitive enough for comparison. (**NMED Exhibit 179 (AR 33121),** AR 12216, and AR 32068)

Permit Section 11.10.4.1.iii, Constituents of Potential Concern, addresses identification of the constituents of potential concern (COPCs). Constituents of potential concern are those chemicals present in environmental media as a result of site-related activities. Chemicals potentially present at the LANL facility fall into three general categories: organic compounds, inorganic compounds, and radionuclides. Organic compounds are mostly man-made chemicals that are not present naturally in the environment. Examples of organics are petroleum-based fuels, chlorinated solvents, and pesticides. As organics are not commonly found to exist naturally in the environment, organic chemicals detected at a site are retained as constituents of potential concern in the risk assessment.

Inorganic compounds, the most common of which are metals, are often found naturally in the environment. This is because all soil and rocks are comprised of various metal-bearing minerals. In order to determine whether inorganics detected on site are naturally occurring, a site-attribution analysis is conducted. This analysis compares background data (data collected from areas not impacted by site activities and selected to be representative of natural conditions) to site data. The initial analysis is conservative and includes a comparison of the maximum detected site concentration to the background reference value. Those metals that have maximum site concentrations less than the background reference values are considered to be representative of background and are not retained as a constituent of potential concern. The Applicants have conducted an extensive study to determine natural background levels in various media to include soil, sediment, and tuff and to derive background reference values for use in determining whether inorganic constituents of potential concern are present. If the initial step indicates that the metal concentration may be elevated when compared to background, a more rigorous evaluation of data may be conducted. This may include a statistical analysis to see if the site's sample data are significantly different from the background data, graphical analysis, and/or geochemical assessments. A subset of inorganic compounds includes essential nutrients (*e.g.*, calcium, sodium, and/or magnesium). Site concentrations are compared to recommended daily allowances or other nutritional guidelines. All inorganics found to be present above natural background or above nutritional guidelines are retained as constituents of potential concern.

Radionuclides that are naturally present (*e.g.*, Uranium-238, Thorium-228, and Potassium-40) and some fallout nuclides (*e.g.*, Cesium-137, Strontium-90, and Tritium)

are evaluated following the above discussed process of site attribution analysis for inorganic compounds. All man-made radionuclides (*e.g.,* fission products, Cobalt-60) are retained as constituents of potential concern.

The risk assessment will address risks for all constituents of potential concern retained after the site attribution analysis. (**NMED Exhibit 177 (AR 33120), NMED Exhibit 181 (AR 33116), AR 9572,** NMED Ex. 136, NMED Ex. 135)

Permit Section 11.10.4.1.iv, Exposure Point Concentrations, addresses the exposure point concentration, which is a representative concentration of each contaminant in a given medium (*e.g.,* soil) to which the receptor may be exposed. If sufficient data are not available to statistically determine an exposure point concentration, the maximum detected concentration is used for risk assessment. If sufficient data are available (ten or greater detections), then an estimate of the upper confidence limit of the mean concentration is determined using distributional-based statistics. While any U.S. Environmental Protection Agency (EPA) or Department-approved guidance and methodology may be used for determination of the upper confidence limit, the most commonly used program is EPA's ProUCL. ProUCL also has built-in methods for handling non-detects. Exposure point concentrations are determined for each chemical in each medium evaluated in the risk assessment. (**AR 14197,** NMED Ex. 135, NMED Ex. 136, and AR 13451) For inhalation of indoor air, the exposure point concentration is determined using vapor intrusion models, such as the EPA's Johnson and Ettinger model. It is difficult to measure the concentrations of a chemical present due to site contamination in a building. Complexities include interferences from off-gassing of chemicals from household cleaning products, carpets, paints, fiber board, etc. In

addition, air circulation and ventilation creates uncertainty. To predict potential indoor air concentrations from volatile organic compounds that may be present in soil and/or groundwater beneath a structure, models that assess how vapors will migrate and accumulate into a building are used to estimate indoor air concentrations. The modeling results are used as the exposure point concentration for the indoor air pathway. (**NMED Exhibit 176 (AR 33146)** and AR 14197)

Permit Section 11.10.4.1.v, Toxicity Assessment, addresses the calculation of carcinogenic and noncarcinogenic risks/hazards. Chemicals may exhibit carcinogenic or noncarcinogenic effects (or both). A carcinogen is a chemical that is known to cause cancer. A noncarcinogen is a chemical that causes adverse impacts to health other than cancer. Examples would include neurological disorders, liver toxicity, or kidney failure. Toxicological data are applied in conjunction with exposure point concentrations and other exposure parameters as a way to estimate the probability that the receptor would develop an adverse health impact. Most of the toxicological data are based upon animal studies conducted in a laboratory where experimental concentrations are extrapolated for use in evaluating risk to humans. As not all studies have undergone extensive peer review, the EPA has set forth a hierarchy of databases for obtaining toxicity data for use in risk assessments. Use of data following this hierarchy will ensure a technically defensible toxicity assessment. (NMED Ex. 136, NMED Ex. 135, and AR 32068)

Permit Section 11.10.4.1.vi, Risk Characterization, concerns quantification of results. After constituents of potential concern have been determined, exposure point concentrations calculated, and toxicity data obtained, the final quantitative step in the risk assessment is to calculate carcinogenic risks and noncarcinogenic hazards. If more than

one constituent of potential concern is present in a given medium, then it is important to evaluate the cumulative risk and hazard and not just the risk/hazard associated with exposure to a single constituent. In addition, risks and hazards across all complete exposure pathways are summed, resulting in assessment of the cumulative risk/hazard. (NMED Ex. 136 and NMED Ex. 135)

Permit Section 11.10.4.1.vii, Uncertainties, calls for a discussion of uncertainties, the last component of a risk assessment. All risk assessments involve the use of assumptions, professional judgments, and to some extent imperfect data resulting in uncertainty in the final estimates of risk and hazard. Uncertainty can be introduced into the assessment with every step of the process, as outlined in the preceding discussion. General areas of uncertainty include: 1) the selection of constituents of potential concern; 2) conservative exposure scenarios and hypothetical receptors; 3) exposure assessments and use of modeling; and 4) application of toxicological data extrapolated for use in the human health assessment. As such, it is important to address these uncertainties and how they may impact the conclusion and interpretation of the conclusion. (NMED Ex. 135)

Permit Section 11.10.5, Site-Specific Ecological Risk Assessment Methods, addresses refined methods for conducting ecological assessment. If the screening level ecological risk assessment indicates elevated hazard to a receptor, additional analysis using a more refined approach and site-specific data may be needed. The Department, the Applicants, and the EPA have standardized guidance for performing site-specific ecological risk assessments, and these approved guidance and methodologies should be applied if a refined assessment is needed. (**NMED Exhibit 180 (AR 33147), AR 14028,** NMED Ex. 136, NMED Ex. 138)

Permit Section 11.10.6, Determination of Background, calls for an appropriate background data set. To assess whether contaminants that are detected are attributable to natural conditions or are related to site activities, determination of natural background levels is important. EPA has clear guidance on how to select a background area. In some cases, where there is complex geology and different soil types, more than one background area is needed. The Permittees have established background concentrations for soil, canyon sediment, and tuff. However, if additional background data are needed, to include development of background groundwater data, the methodology outlined in this condition should be followed. (**NMED Exhibit 181 (AR 33116),** NMED Ex. 136, and AR 32068)

Permit Section 11.10.6.1, Comparing Site Data to Background, reiterates the procedure for comparing site data to background as provided in condition 11.10.4.1.iii. The site attribution analysis for an ecological risk assessment is conducted in the same manner as that for the human health risk assessment. (NMED Ex. 136, NMED Ex. 181, AR 32068)

In my opinion, the procedures for risk assessment in the February 2, 2010 Proposed Permit, Permit Sections 11.10.4, 11.10.5, and 11.10.6, are based on standard risk assessment methodology. They are reasonable and appropriate permit conditions.

The following is a list of references upon which I relied in my review of Permit Sections 11.10.4 through 11.10.6. All of the listed references are sources normally relied upon by persons in my profession in performing and reviewing risk assessments.

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IV. DEPARTMENT'S INTENT TO DENY PERMIT FOR TA-16 BURN UNITS

Technical Area 16 (TA-16) at Los Alamos National Laboratory (LANL) contains two historic burning units (TA-16-388 and TA-16-399), which have operated under interim status. The Permittees submitted an application to permit these burn units. Air modeling and soil sampling were conducted to assess human health and ecological impacts from past and future operations. Based on the assessments submitted to date, the Permittees have not provided sufficient demonstration that continued operation of the burning units would not result in adverse risk to the environment.

a. Air Modeling.

To assess future impacts to human health and the environment, Department contractors conducted air modeling using the Open Burn Open Detonation Model (OBODM). OBODM was developed at the U.S. Army Dugway Proving Ground to specifically evaluate release and dispersion characteristics from open burn/open detonation (OB/OD) operations, such as those proposed by the Applicants. OBODM shows how emission products from open burning will rise and transport and disperse downwind. These predicted data are used to estimate deposition of the emission products onto soil. OBODM was applied to: 1) understand depositional patterns at TA-16 from open burn activities; and 2) evaluate the extent of impacts from conducting propane assisted burns. Two runs were conducted: one assuming 35 pounds of high explosive contaminated waste and a second burning 250 pounds of high explosive contaminated waste. The results from OBODM indicated that there was a dominant depositional area to the north and to the east/southeast of the burn units. The depositional patterns were the same regardless of the weight of waste burned. The only difference between the two

scenarios was the extent of deposition. In addition, the OBODM indicated that there was potential for adverse ecological risk due to dioxin/furan congeners from future operations of the burn units.

A second modeling approach using the model CALPUFF, which can estimate concentrations of pollutants from non-steady-state emission sources, was used by the Applicants. The results from CALPUFF were compared to the results from OBODM. While there was no correlation between the maximum deposition and the estimated risks, the dominant areas of deposition as predicted by CALPUFF were consistent with those predicted by OBODM. Both OBODM and CALPUFF indicated that the primary areas of dispersion and deposition are to the north and east/southeast of the burn units. This means that these areas are predicted to have the highest magnitude of impact from future operations of the burn units.

b. Soil Sampling.

To verify the results of the air modeling, the Department requested that discrete surface soil samples be collected. A total of 36 locations were sampled by the Applicants for analysis for dioxin/furan congeners and 31 locations for metals analysis. Concentrations of dioxin/furans as well as metals detected above background levels were plotted on a site map. The highest concentrations of all data were found to the north and east/southeast of the burn units. The soil data confirmed the deposition pattern predicted by both OBODM and CALPUFF. Since both the modeling and soil data are consistent, I concluded that the levels of contamination detected within TA-16 were a result of past operation of the burn units at TA-16 and that contamination detected in soil at TA-16

(and especially in the predicted modeled high concentration fallout area to the north and east/southeast) is not likely to be from other sources.

c. Risk Assessment.

The results from the soil sampling were also evaluated in a human health and ecological screening level risk assessment to determine if the burn units could be operated in the future in a manner protective of human health and the environment.

A risk assessment is conducted to assess if constituents in various environmental media could cause harm to humans or animals that come into contact with them. The risk assessment is a tool that provides an understanding of potential risks posed by contamination in the absence of any cleanup or removal. In the case of the TA-16 burning ground, this would equate to assessing risks posed by contamination due to past operations of the units.

Risk assessments address the following four basic questions:

1. Who [humans (resident or industrial worker) and/or animals] could potentially be exposed and to what levels of contamination in the environmental media (*e.g.*, soil, air, vegetation)?
2. How could this exposure to site contamination occur (e.g., ingestion, inhalation) and how often may they be exposed (*e.g.*, frequency at site, amount of food ingested)?
3. How do chemicals affect health (toxicity)?
4. What is the potential for actual risk and what level of risk is deemed acceptable?

d. Human Health Risk Assessment.

The screening level risk assessment conducted by the Applicants evaluated both an industrial worker and a hypothetical resident who could be exposed to contamination through ingestion, inhalation, and dermal contact with contaminants in soil. Methodologies outlined in the New Mexico Soil Screening Guidance were followed, and site concentrations were compared to the 2009 Soil Screening Levels (SSLs). Three noncarcinogens were determined to be constituents of potential concern: barium, cadmium, and silver. One group of constituents was identified as carcinogenic constituents of potential concern: dioxins/furans. The resulting risk calculations indicated that risk was below the New Mexico target level of 1E-05 (one in 100,000) for cancer risk, and that toxicity was below the New Mexico target hazard index level of 1.0, for both an on-site industrial worker and a hypothetical resident. Since a screening level approach is deemed conservative, and the results were below target risk/hazard levels, additional analysis of human health risk was not required.

e. Ecological Risk Assessment.

The same constituents of potential concern were identified for the ecological risk assessment: barium, cadmium, silver, and dioxin/furans. The ecological screening level risk assessment included several indicator species: kestrel, robin, deer mouse, desert cottontail, red fox, Montane shrew, earthworm, and plants. The only identified protected species potentially present in the TA-16 area was the Mexican spotted owl. The kestrel, which is a high trophic level carnivore, was used as a surrogate receptor for the owl.

For the initial screening assessment, the Applicants applied very conservative assumptions, to include maximum ingestion rates, an assumption that contaminants are

100 percent bioavailable, and use of toxicity reference values based on no-observed adverse effect levels (NOAELs). The results of this initial screen indicated that there were elevated hazards (above the target hazard level of 1.0) for the robin, deer mouse, earthworm, red fox, Montane shrew, and plant. The results of the screening assessment showed there was no adverse risk for the kestrel, Mexican spotted owl, or desert cottontail.

Following currently accepted Department guidance, the Applicants applied area use and population use factors. These factors account for how much of the actual home range of each receptor is included in potentially impacted areas. The adjusted hazard quotients indicated acceptable risk for all receptors with the exception of the deer mouse, Montane shrew, plant, and earthworm, which had hazards indicative of low to moderate risk.

The site maps of soil sampling results indicated an area of clearly elevated concentrations compared to the rest of the TA-16 site. This area corresponded to the predicted area of maximum fallout identified in the modeling conducted by both the Applicants and the Department. To assess potential risk to this area of highest impact, a spatial assessment was conducted for the deer mouse and Montane shrew. These two receptors were selected as they appear to be the most sensitive species and had the highest hazard quotients. The results of the spatial analysis indicated slightly elevated hazard (1.9) for the deer mouse but acceptable hazard (below 1.0) for the Montane shrew.

f. Uncertainties.

The risk assessment as conducted by the Applicants applied conservative toxicity reference values based on NOAELs. The NOAEL is the maximum quantity of a

chemical that results in no detectable adverse effect. Use of NOAELs results in a conservative estimation of risk and is useful in initial screening level assessments. However, if the NOAEL-based assessment results in a hazard quotient greater than the target level of 1.0, additional refinements are needed. Typically, a less conservative toxicity reference value based on the lowest-observed adverse effect level (LOAEL) is applied. The LOAEL is the lowest concentration at which an adverse effect is observed. LOAELs are often more representative of population risks. The potential for an adverse effect cannot be ruled out without first looking at the risk using a LOAEL. The results of the ecological risk assessment indicated elevated risk (low) to the deer mouse based on the use of NOAEL-based toxicity reference values, but as the Applicants did not conduct a more refined analysis using a LOAEL, there is uncertainty associated with the calculated hazard and an overall conclusion of ecological risk could not be made.

g. Comparison of TA-16 Levels to Canyons:

The Applicants compared dioxin/furan levels detected at TA-16 to levels detected in canyons within the LANL facility, including Los Alamos Canyon, Pueblo Canyon, and Pajarito Canyon. These areas were selected by LANL as potentially being areas that may be representative of ambient (background) concentrations of dioxins/furans. As part of this comparison, the Applicants indicated that biota studies are currently being conducted in these canyons and to date, the results of these studies have not shown adverse impacts to small animals (*e.g.,* deer mouse). The range of dioxin/furans detected in soil in these canyons was approximately 2E-10 (number is in scientific notation and is equivalent to 0.0000000002) to 5E-06 (0.000005) milligrams per kilogram (mg/kg). The Applicants indicted that the 95 percent upper confidence level of the mean for TA-16 was 6.65E-06

(0.00000665) mg/kg, which is similar to Los Alamos Canyon, Pueblo Canyon, and Pajarito Canyon. It is agreed that for most of TA-16, detrimental impact to small animals was not likely to occur, as shown by the spatial assessment of hazard. However, the area of elevated contamination identified by both the models and soil sampling predicted dioxin/furan concentrations an order of magnitude higher than either the TA-16 upper confidence level or the upper confidence levels for other LANL canyons. This indicates that there is an area of higher impact from past burn operations, adding uncertainty to assessment of the areas of highest impact around the burn units. It is not clear from the comparison of the area within the predominant fallout zone for contaminants with other areas not shown by the modeling to be directly impacted by burning operations that there is a correlation in concentrations.

h. Conclusions.

Evaluation of the human health risk assessment and soil data indicate there are no adverse impacts from exposure to current levels of contamination to either residential or industrial receptors. The air modeling indicated elevated risk in close proximity to the burn units, but on a site-wide basis, confirmed that risk above target levels to human receptors is not likely from continued operations of the burn units. This was also confirmed with the analysis of soil samples, resulting in risk below target levels to human receptors.

In evaluating the ecological assessment as submitted by the Applicants, there is low to moderate ecological risk to non-protected species, to include the deer mouse, Montane shrew, and earthworm. If we assume that the current soil concentrations are baseline conditions for the start of future operations, the result is that baseline indicates

some low to moderate risk. Continued operations of the burn units will only result in increasing soil contamination and, as a result, increasing risk. This leads to uncertainty that operation of the burn units can be done in a manner protective of the environment. A more refined site-specific assessment, incorporating LOAELs, and potentially an assessment of bioavailability and evaluation of routes of ingestion, is needed to determine whether past operations at TA-16 combined with continued burn operations at TA-16 would result in adverse ecological risk.

I, Paige Walton, swear under penalty of perjury that the foregoing is true and correct.

_____

Paige Walton
Senior Scientist and Program Manager
AQS, Inc.

Subscribed and sworn to before me this __ day of March, 2010 by Paige Walton

_____

Notary Public

My commission expires:

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I, Paige Walton, swear under penalty of perjury that the foregoing is true and correct.

Paige Walton

Paige Walton
Senior Scientist and Program Manager
AQS, Inc.

Subscribed and sworn to before me this 12 day of March, 2010 by Paige Walton

Notary Public

My commission expires:

9-23-2013

NOTARY PUBLIC
LAUREL S NUNEZ
580272
My Commission Expires
September 23, 2013
STATE OF UTAH