Private Fuel Storage, L.L.C.

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SUMMARY OF CHANGES FOR PFSF LICENSE APPLICATION AMENDMENT #22
DOCKET NO. 72-22 / TAC NO. L22462
PRIVATE FUEL STORAGE FACILITY
PRIVATE FUEL STORAGE L.L.C.

Reference: PFS letter, Parkyn to U.S. NRC, License Application Amendment #22, dated March 30, 2001

The purpose of this letter is to summarize the various changes made in Amendment #22 to the Private Fuel Storage Facility (PFSF) License Application submitted with the above referenced letter. The changes can basically be grouped into four major categories:

- Changes due to the revised design basis ground motion
- Changes due to the revised storage cask/pad spacing
- Changes to the Canister Transfer Building design
- Other miscellaneous changes

A description of each category of changes along with an explanation for the change is given below. We have also provided a list of supporting analyses and reports that were revised as a result of the changes.

REVISED DESIGN BASIS GROUND MOTION

Re-evaluation of previously collected test data for the PFSF site indicated that some of the data that had not been completely incorporated into the PFSF Fault Evaluation Study and Seismic Hazard Assessment, prepared for PFS by Geomatrix Consultants, Inc., needed to be incorporated. Specifically:

1. The seismic shear wave velocity profiles obtained during the 1999 cone penetration testing program at the site for the top 30 feet of soil were evaluated

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by Geomatrix and incorporated into the calculation "Soil and Foundation Parameters for Dynamic Soil-Structure Interaction Analysis, 2000-Year Return Period Design Ground Motions." However, Geomatrix concluded at the time that these velocity profiles were consistent with the average velocity profile used in the "Fault Evaluation Study and Seismic Hazard Assessment" and that revisions to that Assessment were not required.

2. The unit weight for the soil for both the Skull Valley and generic California deep soil profiles used in the original Fault Evaluation Study and Seismic Hazard Assessment was 131 lb/ft^3. The appropriate unit weight for the soil at the PFSF varies from 80 lb/ft^3 near the surface to 115 lb/ft^3 at a depth of 26 ft. It was initially concluded that this difference in unit weight was not a significant contributor to the outcome of the Fault Evaluation Study and Seismic Hazard Assessment.

A re-evaluation of the above two items determined that the Fault Evaluation Study and Seismic Hazard Assessment needed to be revised to include these differences. When the Fault Evaluation Study and Seismic Hazard Assessment was revised to account for these differences, it predicted new Peak Ground Accelerations (PGA) of 0.711g horizontal and 0.695g vertical. This change in the design basis ground motion, in turn, necessitated that the following reports and analyses to be revised:

Geomatrix Consultants, Inc.

- Calculation No. 05996.02–G(PO18)–2, Revision 1, entitled "Soil and foundation parameters for dynamic soil-structure interaction analysis, 2000-year return period design ground motions"
- Calculation No. 05996.02–G(PO18)–3, Revision 1, entitled "Development of Time Histories for 2000-year return period design spectra"
- Fault Evaluation Study And Seismic Hazard Assessment, Revision 1, March 2001
- Development of Design Basis Ground Motions for the Private Fuel Storage Facility, Revision 1, March 2001.

Holtec International

- Multi Cask Response at the PFS ISFSI from 2000-Yr Seismic Event (Rev. 2), Holtec Report No. HI-2012640, dated March 29, 2001.

International Civil Engineering Consultants, Inc

- Storage Pad Analysis and Design, calculation number 0599602–G(PO17)–2, Revision 3, dated April 5, 2001.

Stone and Webster

- Calculation No. 05996.02–SC–4, Revision 2, entitled "Development of Soil Impedance Functions for Canister Transfer Building"

- Calculation No. 05996.02–SC-5, Revision 2, entitled "Seismic Analysis of Canister Transfer Building"
- Calculation No. 05996.02–SC-10, Revision 1, entitled "Seismic Restraints for Spent Fuel Handling Casks"
- Calculation No. 05996.02–G(B)-04, Revision 7, entitled "Stability Analysis of Cask Storage Pads"
- Calculation No. 05996.02–G(B)-13, Revision 4, entitled "Stability Analysis of the Canister Transfer Building Supported on a Mat Foundation"

The following is a list of the sections of the License Application that were updated to incorporate the results of these revised reports and analyses:

- Section 2.6.2 of the SAR was revised to incorporate results of the revised site response analyses. Section 2.6.1.12 of the SAR was updated to incorporate the results of revisions to the dynamic stability analyses of the storage pads and the Canister Transfer Building resulting from changes to the PFSF design basis ground motion. SAR Section 2.6.4.9 was updated to identify the new design basis ground motions. Changes to maintain consistency were also made to other subsections of Section 2.6 of the SAR.
- Section 2.6.1.12 of the SAR was revised to update the discussions of the results of dynamic stability analyses of the storage pads and the Canister Transfer Building resulting from changes to the PFSF site design basis ground motion.
- SAR Section 2.6.4.9 was updated to identify the new design basis ground motions.
- Changes to maintain consistency were also made to other subsections of Section 2.6 of the SAR.
- An explanation was provided in Appendix 2G that the conclusions of the Appendix had not changed, even though the design basis ground motion values were revised in this recent revision.
- Section 3.2.10.1.1 of the SAR was revised to reflect the site-specific horizontal and vertical response spectra associated with the new design basis ground motion.
- Changes to maintain consistency were also made to other subsections of Section 3.2.10 of the SAR.
- Section 4.2.1.5.1(H) of the SAR, which evaluates the structural design of the storage cask under seismic conditions, was updated to reflect the results of the HI-STORM storage cask stability analyses based on the new seismic response spectra.
- SAR Section 4.2.3.5.1 was revised to reflect the dynamic analyses of the storage pads for the new design basis ground motion.
- SAR Sections 4.7.1 and 4.7.2 were updated to incorporate changes resulting from the new seismic loads.

- SAR Section 8.2.1 was revised to reflect the new design basis ground motion and the results of the HI-STORM storage cask stability analyses based on the new seismic response spectra.
- The discussion of the stability of a loaded cask transporter under seismic conditions (Section 8.2.6.2) was updated for the new design basis ground motion.
- Section 2.6 of the PFSF Environmental Report, which includes a summary of the geotechnical and seismic information in Chapter 2 of the SAR, was updated to be consistent with the information presented in the SAR.
- Section 2.6.5 of the ER was revised to incorporate the changes made to the velocity profiles and resulting changes to the site response analyses and idealized soil profiles that were used in the soil-structure interaction analyses.
- ER Section 2.6.8 was updated to identify the new design basis ground motion.
- Changes to maintain consistency were also made to other subsections of Section 2.6 of the ER.

STORAGE CASK/PAD SPACING

In the process of preparing the specification for the PFSF storage cask transporter, it was determined that current transporter designs have become larger than those evaluated in the PFSF design (the PFSF design for the Canister Transfer Building and cask storage area had been based on a transporter used at Point Beach). The dimensions of the new generation transporters that have been designed to date for use with HI-STORM storage casks have been substantially larger than those provided by the designer/fabricator of the Point Beach transporter.

Based on extensive discussions with two transporter vendors, we concluded that the PFSF design should accommodate transporter dimensions of up to 17'-4" wide and approximately 25-ft long. With the previous 15-ft center-to-center spacing between storage casks, the clearance between the outside edge of the transporter and an adjacent cask could be as little as 3 inches, assuming worst case cask placement tolerances. Such limited clearances would make cask placement difficult and time consuming, and could create a risk of the transporter bumping an adjacent cask. Increasing the cask spacing to 16-ft would increase the most limiting clearance to 1'-3", improving operational ease in placing the casks. Therefore, it was decided to increase the length of each pad from 64-ft to 67-ft, which provides for the 16-ft center-to-center cask spacing in the pad length direction (north-south). The cask spacing in the pad width direction (east-west) remains at 15-ft. Since there are 20 pads in a column in the cask storage area, from north to south, the total additional length required to accommodate the new pad size is 20 x 3-ft = 60-ft. This 60-ft distance was accommodated by reducing the 150-ft space between the north and south pad quadrants to 90-ft, therefore not impacting the overall outer dimensions of the cask storage area or the location of the Restricted Area (RA) fence.

In discussions with the transporter vendors it was determined that the anticipated diagonal length of this larger transporter is approximately 30-ft. Since the aisles between the pads were previously 30-ft wide, the increased diagonal length could involve contact with one or both pads on either side of the aisle. Both vendors recommended a minimum aisle width of 35-ft to make the turn without interference and potential damage to a pad edge. Therefore, it was decided to increase the aisle spacing between columns of pads from 30-ft to 35-ft. Reducing the 150-ft space that previously existed between the east and west pad quadrants to 35-ft, allowed the aisle width to be increased to 35-ft between each of the 25 columns of pads with no change in the overall outer dimensions of the cask storage area or the location of the Restricted Area fence.

As a result of discussions with the cask transporter vendors, it was decided not to construct the storage pads 3.5 inches above grade to accommodate potential settling. Rather, the pads will be constructed so that their tops are level with grade. Any settling of the storage pads is now expected to be minimal due to the presence of an underlying soil cement layer, and would be addressed by scraping crushed aggregate from between pads so that the aggregate layer was flush with the top of the pads if the need arose.

The following analyses and changes to the License Application documents were required as a result of the changes in the cask/pad spacing described above:

- Technical Specification Design Feature 4.2.3 was revised to specify the new storage cask spacing requirements.
- A number of figures were revised to show the new cask/pad spacing, such as the PFSF General Arrangement drawing that appears in the SAR, ER, and EP.
- Holtec reanalyzed dose rates at the RA fence, the owner controlled area boundary, and at the nearest residence (approximately 2 miles from the PFSF) using an assumed array of 4,000 HI-STORM storage casks based on the new cask/pad spacing. Maximum doses (at the north RA fence and OCA boundary), and doses at the nearest residence, increased marginally (less than 5%) from the previous dose analysis. The results of this dose assessment are discussed primarily in SAR Section 7.3.3.5. The dose rates calculated in Holtec's dose assessment were used to reevaluate doses to construction workers in ER Section 4.1.9, and doses to wildlife postulated to spend time at the RA fence, in ER Section 4.2.9. As a result of the changes in cask/pad spacing, the following reports and analyses were revised to reflect the changes in dose rates:

    1. Holtec International "Radiation Shielding Analysis for the Private Fuel Storage Facility (Rev 2), Holtec Report HI-971645, March 16, 2001.
    2. S&W Calculation No. 05996.02–UR–5, Revision 2, entitled "Dose Rate Estimates from Storage Cask Inlet Duct Clearing Operations"

3. S&W Calculation No. 05996.02–UR(D)–8, Revision 1, entitled "Dose Rate Calculations at PFSF Locations Potentially Accessible to Wildlife and Estimates of Annual Doses to Individual Animals"
4. S&W Calculation No. 05996.02–UR(D)–11, Revision 1, entitled "Personnel Dose Rate Estimates During Construction of the Storage Pads at the Private Fuel Storage Facility"
5. S&W Calculation No. 05996.02–UR(D)–12, Revision 1, entitled "Dose Rates From the 4000 Storage Cask PFSF Array Representative of PFSF Typical Spent Fuel, Assumed to be PWR Fuel Having 35 GWd/MTU Burnup and 20 Year Cooling Time"

- Holtec reevaluated the site-specific HI-STORM storage cask thermal performance based on the revised cask/pad spacing. (Holtec International, "Additional Thermal Evaluation of the HI-STORM 100 System for Deployment at Skull Valley" Revision 1, Report HI-2002413, dated March, 2001). The results of this thermal assessment are discussed in SAR Section 4.2.1.5.2.
- Changing the length of the storage pads increased the volume of concrete associated with the pads, which impacted the quantity of imported solid construction materials (ER Table 4.1-6) as well as the water volumes drawn from the on-site well(s) during PFSF construction (ER Section 4.5.4). This change in concrete volume due to the storage pad changes had a minor impact on the traffic during PFSF construction which relates to construction noise levels evaluated in ER Section 4.1.7 and air quality, discussed in ER Section 4.1.3.
- Chapter 4 of Appendix B to the License Application, "Decommissioning Cost Estimate", was revised to address the change in storage pad dimensions, which increases the pad surface area (by less than 5%) that could potentially require decontamination.
- The volume of earthwork, discussed in ER Section 4.1.5.2, was revised to account for the new pad spacing/layout. This affected the fugitive dust emissions (Tables 4.1-4 and 4.1-5) and quantity of water required to be trucked in for soil compaction and dust control (ER Sections 4.1.7 and 4.5.4).

CANISTER TRANSFER BUILDING DESIGN

Several changes were made to the Canister Transfer Building to accommodate increased seismic ground motions and transporter changes discussed above, to increase operational efficiency, and to reduce construction effort. These changes include:

- Increasing the area of the base mat. This was done to maintain the desired factor of safety against sliding and overturning for the increased seismic loads.
- As a result of discussions with the transporter vendors it was decided that improved access to the transfer cells should be provided to avoid the 90-degree turns required with the original design to enter the transfer cells. Three additional

doors were incorporated into the West wall of the transporter aisle to make access into the transfer cells easier. It was decided that the tornado missile boundary should be moved from column line A.8 (transporter aisle west wall) to column line C (transporter aisle east wall). Since it is no longer needed as a missile barrier, the concrete wall on column line A.8 was replaced with a steel frame and metal sided wall, as was the wall on column line F (office area).

- The doors entering each transfer cell from the transporter aisle were widened from 20-ft to 22-ft to accommodate a larger cask transporter.
- The building north wall was moved 5-ft in the North direction to accommodate crane hook approach requirements
- As the result of a constructability review, the roof beams were changed from reinforced concrete to structural steel. The roof slabs were reevaluated and the thickness reduced from 1 foot in thickness to 8 inches, while still satisfying tornado missile protection criteria. These changes will reduce construction time and cost.
- The transporter aisle was increased in width by 7-ft to accommodate larger transporters.

SAR Figures 4.1-1, 4.3-1 and 4.7-1 were revised to incorporate these changes.

OTHER MISCELLANEOUS CHANGES

RAI Incorporation

PFS's responses to the NRC's Third Round EIS Request for Additional Information (RAI), NRC Letter, M. Delligatti to J. Parkyn, dated October 24, 2000 were incorporated in the licensing documents, as applicable.

- ER Chapter 7 was updated to include the results of the cost benefit analyses performed in response to the RAI. These analyses account for changes to the PFS membership and the date when it is anticipated that the PFSF will become operational (the latter part of 2003). Several revisions were also made to ER Chapter 1 as a result of these analyses.
- Information on the proposed project schedule was updated in several sections of the licensing documents (SAR Section 1.1, ER Sections 1.3 and 3.2.1, and LA Section 1.8)
- ER Section 1.2 was updated regarding the remaining fuel assembly storage capacity in the PFS member fuel pools (accounting for changes in the PFS membership), and the projected dates for loss of full-core offload capability.
- ER Figure 2.5-2 was updated to reflect the latest information in the Utah Division of Water Rights database concerning water wells within 5 miles of the PFSF site.

<u>Soil Cement</u>

In December 2000, 16 test pits were dug at the PFSF site in the pad emplacement area to obtain soil samples for use in the laboratory analyses necessary to design the soil cement mix. It was observed from these test pits that the depth of the eolian silt was shallower (approximately 2-ft on average rather than 3-ft) than previously believed. The earlier borings performed in this area obtained soil samples at approximate depths from grade to 2-ft and from 5-ft to 7-ft; therefore, the interface layer between the eolian silt and the silty clay/clayey silt fell between the samples collected. Our previous interpretation of the tip resistance curves (Q_t) from the near-surface cone penetration tests conservatively assumed that this boundary was where the initial spike in tip resistance bottomed out, in order to obtain an upper-bound estimate of the amount of soil cement required. This increase in tip resistance was previously interpreted as a layer of slightly cemented eolian silt. As observed in the soil cement test pits, the interface layer between the eolian silt and the silty clay/clayey silt is actually at a depth corresponding to the initial increase in tip resistance. This reduced amount of eolian silt results in the need for less soil cement under the cask storage pads (See SAR Figure 4.2-7).

Two different soil cement mixes will be required in the pad emplacement area. The soil cement to be placed above the base of the pads will have higher strength, to provide sufficient horizontal resistance to obtain a factor of safety against sliding that exceeds the criterion (FS=1.1) for dynamic loadings and to withstand environmental loads due to freeze/thaw and wet/dry cycles. The strength of the soil cement beneath the pads must be limited to satisfy the modulus of elasticity requirements of the hypothetical cask tipover analysis, but it must still provide an adequate factor of safety with respect to sliding of the pads embedded within the soil cement. Analyses indicate that designing the soil cement that will be placed under the pads to have an unconfined compressive strength that ranges from 40 psi to 100 psi will provide an adequate factor of safety against sliding and will limit the modulus of the soil cement under the pads to an acceptable level for the hypothetical cask tipover considerations.

The large extent of soil-cement in the storage pad emplacement area allows the soil-cement layer to be considered as part of the free field soil profile for the site response analyses. The properties of the soil cement, higher shear wave velocity and higher density than the existing soils in the area, help to minimize the response at the surface of the site caused by the design basis ground motion. Soil cement was added around the Canister Transfer Building foundation mat to make the free field soil profile for the building consistent with that for the storage pad emplacement area and to help resist sliding forces due to the new higher design ground motions. The soil cement extends out from the foundation mat a distance equal to one mat dimension in each direction from the foundation mat. The depth of the soil cement is 4'-4" with an 8 inch layer of crushed aggregate on top. This is discussed in SAR Section 2.6.4.11.

These changes in the use of soil cement resulted in a net increase of approximately 10% in the amount of soil cement needed for the facility.

Storage Cask Tipover and Vertical End Drop Analyses

The tipover and vertical end drop analyses documented in the HI-STORM FSAR assume a concrete thickness of 36 inches, a concrete compressive strength of 4,200 psi (at 28 days), reinforcement at the top and bottom (both directions) of the pad consisting of 60 ksi yield strength ASTM material, and a soil effective modulus of elasticity of 28,000 psi. The PFSF pads are 36 inches thick, the pad concrete compressive strength shall not exceed 4,200 psi (at 28 days), and the pad reinforcing bar is 60 ksi yield strength ASTM material. The soil foundation beginning not more than 2 foot below the ISFSI pad concrete has an effective soil Young's Modulus not exceeding 28,000 psi. However, the soil-cement mixture extending a maximum of 2 feet directly below the ISFSI pad has an effective Young's Modulus not to exceed 75,000 psi. To ensure that the HI-STORM storage cask 45g limit at the top of the fuel is met, PFSF site-specific tipover and vertical drop events were analyzed by Holtec International (Holtec Report No. 2012653, PFSF Site-Specific HI-STORM Drop/Tipover Analyses) using the same methodology and computer codes used in the analyses discussed in the HI-STORM FSAR.

The results of these analyses are discussed in Sections 4.2.1.5.1E, and 8.2.6 of the PFSF SAR. The results from the site-specific hypothetical tipover analysis demonstrate that the maximum deceleration at the top of the active fuel region is below the HI-STORM design basis value of 45g. The results from the site-specific vertical end drop analysis determine that the maximum cask deceleration remains below 45g for a 9 inch drop height. This required a change to PFSF Technical Specification 4.2.5, "Cask Transporter", to require that the cask transporter be designed to mechanically limit the lifting height of a storage cask to a maximum of 9 inches (the previous maximum permissible lift height was 10 inches). This change in the analyzed drop height maximum permissible lift height required revisions to several other sections in the SAR, and in the Emergency Plan.

Truck Trips

Changes were made to the number of truck trips required to support PFSF construction (imported material truck trips and water truck trips) in ER Section 4.1.7 and Table 4.1-3. The imported material quantities that were substantially modified were the common fill material, materials needed to produce concrete (sand, large aggregate, cement), and soil cement (cement and water). It was previously assumed that the common fill material would be imported. The current design utilizes a site earthwork balance where no common fill material is imported. The overall concrete volume for the facility construction has increased as a result of the increase in the length of the storage pads and the increase in size of the Canister Transfer Building basemat. The site soil cement quantities have increased as discussed above.

The water requirements for PFSF construction are dependent upon the imported material quantities. Imported water is required for making soil cement, and for compacting soils and controlling dust. Since the earthwork and soil cement quantities have changed, the water needs for making soil cement and conducting earthwork activities (compacting soils and controlling dust) changed accordingly.

The following changes to the License Application documents and analyses were required as a result of the changes in the imported material and water truck trips described above:

- Sections 4.1.7.1 through 4.1.7.3 of the ER discuss the effects of noise and traffic for the three construction phases of the PFSF. Truck trip quantities along with noise levels generated from the trips were modified in these sections. These values are also reflected in Tables 4.1.3 and 4.1.6 of the ER.
- Information regarding the volume of concrete production, quantities of earthwork affected, quantities of aggregate, and construction traffic levels associated with phase 1 facility construction were used to revise information on air pollution and air quality impacts in ER Section 4.1.3, and ER Tables 4.1-4 and 4.1-5.

The supporting calculations were also revised as follows:

- The revised water requirements for PFSF construction are calculated in Stone & Webster Calculation 05996.01-P-002 Rev. 5, "Miscellaneous Design Data Required for PFSF Licensing Documents."
- The revised truck trips (imported material and water) are calculated in Stone & Webster Calculation 05996.01-SY-7 Rev. 5, "Truck Traffic Estimates on Skull Valley Road."
- The revised traffic sound levels are calculated in Stone & Webster Calculation 05996.01-E(B)-03 Rev. 3, "Traffic/Sound Levels – Skull Valley Road Construction Thru Operation."

Technical Specifications

PFSF Technical Specification Design Feature 4.2.5, "Cask Transporter", prescribed that the cask transporter was to be designed such as to ensure that it does not begin to tip during the PFSF design basis ground motion. However, this was not consistent with the Technical Specification for the design basis tornado-driven missile for the cask transporter which utilized the drop height limitation. Therefore, for consistency this specification was revised to require that the cask transporter be designed to ensure that the transporter not tip over in the event of the PFSF design basis ground motion, and any tipping must be limited to ensure that the storage cask does not temporarily rise above its analyzed drop height of 9 inches. This now applies the same criteria to the design basis ground motion for the cask transporter that are specified for the design basis tornado-driven missile.

PFSF Technical Specification Design Feature 4.2.6, "Storage Pads", prescribed requirements for the storage pads to assure that the pads and underlying soil are not harder than the reference storage pad upon which the design basis tipover and vertical end drop accidents are based in the HI-STORM FSAR. This specification was originally extracted from Appendix B, Section 3.4.6 of the HI-STORM 100 Cask System Certificate of Compliance (C of C) No. 72-1014. Holtec International revised the corresponding specification in their HI-STAR storage system C of C, and submitted a proposed amendment to this section of the HI-STORM C of C, which would permit site specific analyses to determine that the 45g deceleration HI-STORM design criteria is not exceeded for hypothetical storage cask tipover and postulated vertical end drop events. PFS revised Design Feature 4.2.6 accordingly, requiring that "The storage pads and underlying foundation shall be verified by analysis to limit cask deceleration during design basis drop and hypothetical tipover events to ≤45 g's at the top of the CANISTER fuel basket. Analyses shall be performed using methodologies consistent with those described in the HI-STORM 100 FSAR." This change is reflected in SAR Section 3.2.11.3. Technical Specification 5.5.4, "Onsite Cask Transport Evaluation Program", was revised to be compatible with the revised Design Feature 4.2.6.

Technical Specification Design Feature 4.2.3 was revised to specify the new storage cask spacing requirements, as stated previously.

License Application Chapter 1

Certain information in Chapter 1 of the License Application was updated. For example, the list of the PFS Board of Managers was updated (Section 1.10) to be current. Similarly, the financial information was updated (Section 1.6) to correspond to the information presented by PFS in the licensing proceeding.

Permitting

PFS has updated Chapter 9 of the Environmental Report (Environmental Approvals and Consultation) to take into account the results of the wetland and stream survey conducted by PFS to determine if any jurisdictional waters of the United States are present along the proposed railroad alignment (PFS had committed to such an update in our letter Donnell to U.S. NRC, "Responses to Third Round EIS Request for Information", dated November 7, 2000). This survey concluded that there are no jurisdictional waters of the United States, wetlands or other kinds of water, along the proposed railroad alignment. PFS believes this survey along the rail corridor reflects the characteristics of the entire area around the facility, which has minimal drainage features as compared to the railroad alignment itself. Because of this determination, concurred in by the U.S. Army Corps of

Engineers, various Federal and State permits required under Clean Water Act previously identified in Chapter 9 are not required. Chapter 9 was updated to reflect this detemination and was generally updated as well to reflect PFS's current identification of required permits and status towards obtaining those permits.

If you have any questions or need additional information, please contact me at 303-741-7009.

Sincerely,

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