December 22, 2011

MEMORANDUM TO: Bill von Till, Branch Chief
Uranium Recovery Licensing Branch
Decommissioning and Uranium Recovery
Licensing Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

FROM: Stephen J. Cohen, Team Leader **/RA/**
Uranium Recovery Licensing Branch
Decommissioning and Uranium Recovery
Licensing Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

SUBJECT: PRE-SUBMISSION AUDIT WITH AUC LLC REGARDING THE PROPOSED RENO CREEK IN SITU RECOVERY FACILITY

Enclosed with this memorandum is the report of the November 15-17, 2011 pre-submission audit of AUC LLC's proposed uranium in situ recovery facility at its Reno Creek site in Campbell County, Wyoming. If you have any questions, please contact me.

Enclosure: Report of Meeting

CONTACT: S. Cohen, FSME/DWMEP
(301) 415-7192

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Enclosure: Report of Meeting

cc: Meeting Attendees

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MEETING REPORT

DATE: November 15 - 17, 2011

TIME: 8:00 a.m. to 5:00 p.m.

PLACE: Wright Hotel
300 Reata Drive
Wright, WY 82732
(307) 257-5143

PURPOSE: This meeting was a pre-submission audit performed by the U.S. Nuclear Regulatory Commission (NRC) staff of a preliminary draft application prepared by AUC LLC (AUC) for the proposed Reno Creek *in situ* recovery (ISR) uranium project in the State of Wyoming. An agenda for this meeting is provided as Attachment 1.

ATTENDEES:

See Attached Attendees List (Attachment 2).

BACKGROUND:

AUC submitted a letter of intent to the NRC staff on November 3, 2010, which supplemented its original letter of April 9, 2010. This letter notified the staff that AUC intends to submits an application to operate an ISR facility at the Reno Creek site in Campbell County, Wyoming. By letter dated July 12, 2011, AUC requested a pre-submission audit of its Reno Creek application. This meeting occurred on November 15 - 17, 2011, in Wright, Wyoming, approximately 7 miles east of the proposed Reno Creek facility. AUC intends to submit its application by January 2012.

This pre-submission audit consisted of an introductory briefing and a site tour on the morning of November 15, 2011. During the introductory briefing, AUC presented its groundwater modeling effort, a hard copy of which is included as Attachment 3. During the site tour, AUC distributed various maps and site information, which is included as Attachment 4. Following the site tour, the staff performed an audit of the preliminary draft application. At various points during the audit, the staff posed questions to AUC to clarify any issues identified. Starting at approximately 10:00 a.m. on November 17, 2011, the staff debriefed AUC on its audit results, all of which are described below. The staff did not raise any issues in this report that have not been discussed with AUC during the November 17 debrief.

Enclosure

DISCUSSION:

The following presents the staff comments compiled during the preliminary draft application audit. These comments represent the more important issues discussed with AUC during the debrief meeting. Staff attempted to identify those issues that could not only affect acceptance, but would result in requests for additional information. Any minor comments were written in the preliminary draft documents, which remain with AUC.

Technical Report

General Comments

- AUC should limit the amount of general descriptive language used in the application. Because the Technical Report (TR) is an application instead of a typical data analysis report all descriptions can be viewed as commitments by an applicant. Therefore, if some general descriptions conflict with site-specific information, enforcement confusion could result. To the extent possible, the TR should only contain site-specific information.

- Organization of the application is slightly confusing. The staff recommends a NUREG-1569 checklist that presents the location of required information.

Section 1.0

- Discussion of ISR process needs to be site-specific, as opposed to generic.

- Language on 11,000 gallons per minute (gpm) flow rate is vague. AUC needs to specifically state which flow rate is being requested in the license.

- The Gantt chart presented in the application only addresses the first mine unit. Please provide a general sequence for all mine unit develop, understanding that such sequences are subject to change.

- AUC does not discuss the surety, decommissioning plan, or groundwater restoration.

Section 2.0

- Figure 2.1.3. The deep disposal well is shown outside of the proposed license area in Section 34.

- Section 2.2.1, page 2.2-3. AUC does not describe the extent of oil production. During the site tour, staff observed an oil rig drilling within or near the license area (see NUREG-1569 Section 2.6.3 (5)).

- The application says no residences are in the proposed license area. Please ensure that the status of residences within the proposed license area remains consistent during the application review period and during operations. NRC staff must be notified of changes in the status of residences during both the application review and operational periods.
- Site location and layout map should contain plant outline, pond locations and outline, ore body locations, wellfield locations, and general monitoring well ring locations.

- Restricted areas and fence lines should be identified on a site plan.

- AUC should provide a map locating nuclear facilities within 50 miles of the site.

Section 2.5

- The Year Round Summary data for the regional met data did not appear to reflect the 12 month data. For example, one particular data set showed all the monthly data to be positive values. However, the Year Round Summary was a negative value.

- The staff suggests that AUC include the calibration records of meteorological equipment to demonstrate that the quality of the data is adequate for the staff's review.

Section 2.6

- Figures 2.6a-1 through 2.6a-6. Cross sections are provided on a very large scale (e.g. A-A' is approximately 20,000 feet long and defined with 8 boreholes/wells). Some of the points used to define the cross sections are more than 1 mile apart. Please provide individual cross sections along the major axis of each of the six separate ore bodies using closely spaced well/borehole data that is available. Densely defined cross sections at the local scale of each ore body will enable the staff to analyze the continuity and thickness of aquifers and aquitards to facilitate the review (NUREG-1569 Section 2.6.3 (2)). These higher resolution cross sections should include water levels of the production zone aquifer (PZA), if possible.

- Addendum 2.6b. Please provide isopachs or other appropriate graphics of underlying or overlying sandstones/aquifers. These would be helpful to demonstrate the continuity of these sandstones/aquifers.

- Coal bed methane (CBM) and deep well injection zones are not indicated on any cross sections (NUREG-1569 section 2.6.3 (3)). Please provide one cross section showing these zones.

- A borehole log or cross section showing location of Ft Union aquifers relative to production zone would help the NRC staff evaluate water supply resources relative to production zone aquifers (NUREG-1569, Section 2.6.3 (3)).

Section 2.7

- Please provide surface water reservoirs (Table 2.7a-10) and CBM impoundments within license area on surface water features map (Figure 2.7-3A) (NUREG-1569 Section 2.7.3(1)).
- Please provide a description of CBM impoundment monitoring wells, if any, which may be required by the State of Wyoming.
- Please provide maps showing potential flooding around drainages or in/near planned wellfields/production units. These maps should include those for the 25-, 50-, and 100-year return interval (NUREG-1569 Section 2.7.3(2)).

- Please provide a discussion of erosion protection for wellfields/production unit infrastructure that may be located in any areas subject to flooding from a 25-, 50- or 100-year event (NUREG-1569 Section 2.7.3(2)).
- Figure 2.7a-6 would be enhanced if the WYPDES sample locations were shown relative to drainages and surface water sampling locations.
- In Section 2.7.1.8, some surface water samples show wide swings in iron, manganese, conductivity, TDS, sodium, sulfate, alkalinity, chloride and other constituents between quarters. Please include an analysis to determine if these variations are a consequence of the impact from CBM produced water on surface water quality or some other source.
- Please add ground surface elevations, top of casing elevations, and UTM coordinates of all wells to Table 2.7.2-1 (NUREG-1569 Section 2.7.3(3)).
- Please confirm whether or not the shallow monitoring (SM) unit meets the definition of an aquifer in 10 CFR Part 40, Appendix A.
- If the SM unit is not an aquifer, the overlying aquifer would be the surficial aquifer. Please provide the depth to water in the overlying aquifer across the license area. Depth to water would be helpful to evaluate if leaks at the surface or in wellfield trunklines/piping would contaminate the overlying aquifer.
- Please provide an evaluation of overlying aquifer interaction with any surface drainage.
- Please confirm whether or not the underlying aquifer (UA) meets the definition of an aquifer in 10 CFR Part 40, Appendix A.
- Please provide a map showing measured level data at individual wells for the overlying and underlying aquifer (see NUREG-1569 2.7.3 (3)).
- Page 2.7-32, second paragraph, application seems to state all of the aquifers are experiencing seasonal variation in water levels from “spring thaw and runoff.” If yes, please provide a discussion which supports this conclusion (e.g., an analysis of the magnitude of seasonal/other recharge for each aquifer.)

- PZM-1 and PZM-3 pumping tests indicate large drawdown response at pumping wells PZM 1 and PZM 3. Please address whether these drawdowns may lead to dewatering of production wells at proposed operating rates.
- Page 2.7-45. The UA aquifer test at 1.9 gallons per minute (gpm) for 27 minutes, indicated 104 feet (ft) of drawdown. Data in Table 2.7.2-29 are not at a time scale where the response curve can be evaluated. Please provide more of a description of the underlying aquifer.
- Global comment – the time scale of the pumping tests is not at a resolution to assess early, middle and late time response for specific effects.
- Please provide Stiff and Piper diagrams of pre-operational ground water quality.
- Please check the SM water quality data to evaluate if this water is of the same quality as CBM-produced water.
- Please provide an inventory and completion description of oil/gas wells located within 3 miles of the license area similar to the groundwater and CBM wells shown in Figures 2.7.2-50 and 2.7.2-51.
- Please provide discussions of all private wells in the proposed license area in the TR similar to discussion in Environmental Report (ER) Section 3.4.2.7 (e.g., number of wells, use, yield and aquifer completion). Please describe how these wells in the PZA and OA will be addressed during operations in the TR (like ER 4.4.2.1.). Will these private wells be plugged, recompleted in other zones, etc?

Section 2.9

- There was no discussion regarding fish, livestock, or crop sampling. If no such sampling was performed, please provide a justification. Staff also suggests providing a more complete description of the vegetation types.
- The staff suggests that AUC produce one map with all the environmental sampling points on the map. If possible superimpose a sector diagram on the map. This will allow the reviewer to see if sampling locations are in the proper sector. Also, please provide a table to include each sampling location, sector, and distance from the central processing plant or other designated centroid.
- Section 2.9. Regulatory Guide 4.14 recommends quarterly water quality sampling for total uranium, radium 226, thorium 230, lead 210, and polonium 210 in all private wells that could be used for drinking water or livestock within 2 kilometers (km) of the license boundary. Tables 2.9-16 through 2.9-20 only show that 1 quarter of sampling performed for a limited number of private wells in fall 2010. Please conduct this quarterly sampling for all private wells within 2 km.

- Please provide a table describing the private well completions and map (update 2.7.2-50?) of all private wells within 2 km of the license area that would be part of this quarterly sampling.
- Please note that Figure 2.9-25 is missing.

Section 3.0

- Please provide a commitment to maintain an inward gradient in all production areas until restoration stability monitoring begins. Please provide a discussion of the concentration of dissolved oxygen of the lixiviant. What is the concentration to be injected in the production area in the partially saturated aquifer?
- Please state if hydrogen peroxide will or will not be used in the lixiviant.
- Please provide a discussion of the anticipated operating head in the partially saturated portions of the production areas. Is this head sufficient to maintain the dissolved oxygen concentration in the lixiviant in solution at the injection wells?
- Will injectivity be lost if oxygen comes out of solution in the injection wells in partially saturated portions of the production area? Please address how injectivity loss will be addressed if it occurs.
- Please provide a comprehensive analysis of waste disposal capacity. The application provides the predicted maximum waste disposal rate for the deep disposal wells during operation (115 gallons per minute (gpm)), operation/restoration (183 gpm) and restoration (104 gpm). However, the application does not state what the expected actual rates would be for each disposal well, which often differ from the permitted rates. Based on this expected rate, will four disposal wells meet and exceed this maximum waste disposal rate of 183 gpm? Is excess capacity available if any of the disposal wells goes out of operation (e.g. surge ponds)?
- Please provide an analysis to assess the maximum extraction (production well) rate that can be achieved in partially saturated production areas without dewatering.
- Please provide evidence that an excursion can be captured in the partially saturated production areas without dewatering or “chasing an excursion” with numerous extraction wells. The application presents cones of dewatering that are deep and tight based on pumping test results, which produce smaller capture radii than that of a confined, saturated aquifer.
- Section 3.1.5. Please provide evidence that an inward gradient can be achieved and maintained in the partially saturated production areas. Will the proposed bleed of 0.5-1.5% also be sufficient in the partially saturated zones?
- Please provide actual drawdown analysis and maps of anticipated drawdown within and outside the license area to determine the extent of the drawdown based on maximum

consumptive use in the TR. Page 3-14 only states that the pumping tests indicate negligible drawdown outside the wellfield area.

- Please provide a commitment to determine if any new private well completions are added within 2 km of the license area during the application review and license periods. Please also provide a commitment to evaluate the impact of ISR operation on any new well completions or if any new well will impact hydraulic control of ISR production areas.
- AUC should specify the flow rate being requested in the license application.
- The GEIS should not be used to provide technical justification for the design of the plant.
- Discussions of roll fronts are too generic; these should be more site-specific.
- Discussion of well construction methods is confusing. It appears that either there is no Method 1, or Method 1 is incorrectly labeled.
- Model results regarding offsite water quantity/quality impacts should be provided.
- Model justifications should also be provided regarding flare, ability to recover excursions, and ability to detect excursions.
- It appears that some confusion exists regarding which stream will be treated by operational RO. Will it be the bleed or a portion of barren lixiviant?
- Please provide more detail on tank secondary containment and the volume of tanks vs. volume of containment. Also, please discuss the fate of spilled liquids or method of recovery.
- Please provide a diagram showing the manner in which pressure and flow meters are monitored by AUC staff. Do these meters connect to computers at the main plant?
- Please provide descriptions of dryer monitoring equipment and a statement that hourly measurements of system performance will be made per Criterion 8.
- Please provide waste volume estimates.
- Please provide a map of all wellfields with monitoring wells in the ring and overlying/underlying aquifers.
- The restricted area boundary needs to be delineated, approximate locations of air samplers and radon detectors should be provided. Include a statement that locations are subject to change based on operational needs.
- Please provide information regarding backup systems. What happens when either important components fail or in the event of sustained power outages? The staff is particularly concerned with dryer filtration systems and automatic shutoff valves.

Section 4.0

- Please substantiate the claim that 99% of radon will be recycled.
- Please substantiate the claim that the vacuum dryer system is zero emissions. Manufacturer's information could be used for this purpose. Also provide more specifics on the dryer monitoring systems and the manner in which emissions removal efficiency can be confirmed.
- Please provide AUC's strategy for addressing 10 CFR 40.65 reporting requirements. If modeling or calculations are to be used then provide more specifics on input data.
- Surge ponds. Please confirm the purpose of these ponds because the ER and TR state different functions. Also provide slope stability analyses, embankment designs, and locations of monitoring wells around the ponds.
- Please provide a 10 CFR 20.2002 analysis for disposal wells.

Section 5.0

- The QA manager should be included in Figure 5-1 along with a brief discussion of this person's duties and responsibilities.
- Figure 5.7-5 was referenced in the technical report, but no Figure 5.7-5 was found in the report.
- Please provide one table that includes all of the radiation detectors. The table should also include the *a priori* lower limit of detection. The equation for the lower limit of detection can be found in RG 8.30. Other information should include model number, type of detector (GM, NaI, etc), and range.
- The technical report presented the argument that the concentration of Th-230 in solution is very small. Th-230 is a decay product of U-238. Considering the large quantities of U-238 being process, small quantities of Th-230 contamination could be present in the facility or in outside areas due to spills, leakage, and maintenance activities. Please assess whether or not the presence of Th-230 contamination is possible and the manner in which AUC will address it.
- Please demonstrate the manner in which AUC will determine radon daughter concentrations.
- Please provide more details regarding the respiratory protection program, particularly how AUC will use the respirators and if sanitation will be available.
- Please identify the restricted and control areas at the proposed Reno Creek facility.
- Section 5.7.7 for radon requires some clarification. This section appears to contain information more appropriate for particulate uranium.
- The applicant should review Section 5.7.7 and compare statements from Section 5.7.7 with those in Section 2.9. There appears to be some discrepancies between the two sections and these two sections should be consistent. For example, Section 5.7.7 discusses fish sampling, but fish sampling was not discussed in Section 2.9. If the applicant is making a decision to not sample for fish during the preoperation phase, this should be stated and explained. The applicant should not be silent on a particular

sampling medium for the pre-operation phase and then discuss the same sampling medium in the operation phase.

- Section 5.7.7 regarding fish sampling references a Section 2.8.5.5. No Section 2.8.5.5 was found in the report.
- It is not clear if the applicant plans to sample surface water.

Section 5.7.8

- Section 5.7.8.1.2. Please commit to sample ore zone baseline ground water quality at wells four times and at least 2 weeks apart for all constituents of concern to establish baseline water quality. Typically, if a constituent is non-detect (ND) in the first two samples, it is not necessary for it to be measured in the 3rd and 4th sampling events.
- Section 5.7.8.1.3. Please commit that all overlying, underlying aquifer and perimeter ring monitoring wells will be sampled four times at least 2 weeks apart for all constituents to establish baseline water quality for these wells in case they require restoration. As stated above, if a constituent is ND in the first two samples, it is not necessary for it to be evaluated in the 3rd and 4th samples.
- Please provide an approach to distinguish a monitoring well (MW) excursion or surface water impact that may result from coal bed methane produced water from an excursion caused by ISR licensed activities.

Section 6.1

- Section 6.1.3. Please provide a commitment to conduct excursion monitoring until a production unit/wellfield restoration is approved. Applicant can propose a different excursion sampling frequency after restoration stability monitoring is completed.
- Section 6.1.4.4. Please ensure that NRC restoration standards have been achieved when the applicant requests the start of stability monitoring, from the State of Wyoming. Applicant should also note that NRC regulations require that groundwater concentrations must be ALARA if the applicant did not achieve NRC-approved background or drinking water standards, as required by 10 CFR Part 40 Appendix A Criterion 5B(6).
- Please provide a discussion of how pore volume or flare is to be determined in the saturated or partially saturated portions of the license area.
- Please provide a discussion of how restoration will be modified to ensure sweep of all portions of the partially saturated aquifer which have been exposed to lixiviant (e.g. flipping production/injection wells).
- Need to discuss the manner in which spills will be documented and that spill records will be maintained whether or not reporting is required by regulation.
- No decommissioning cost estimate provided.

Sections 6.3 & 6.4

- Is the residential farmer scenario applicable? If so, why? Why only the external and plant ingestion pathways? What about the other pathways?
- AUC references RESRAD calculations in Appendix C. However, the staff did not find an Appendix C during the review.
- Section 6.4.4.1. Please provide a commitment to continue stability monitoring until four consecutive quarters show no statistically significant increasing trends in the constituents of concern.

<u>Environmental Report</u>

General Observations:

- NRC will use the Environmental Report (ER) as a starting point for preparing its environmental review. Figures in the SEIS will be published in black and white. The figures in the ER are in color. Consider making certain figures available in black and white to support the NRC review.
- Provide a copy of the UIC permit application, if available.
- Provide any feasibility studies conducted to support the determination to use Class I disposal wells for management of liquid effluent.

Key Observations:

- Consider providing a stand-alone chapter on the analysis of cumulative impacts. The analysis of cumulative impacts needs to consider past, present, and reasonably foreseeable future activities. Previous cumulative impacts analyses considered future activities out to about 20 years (license term and one renewal). The analysis needs to be conducted on a resource by resource area (e.g. air, water, etc.) and the geographic area to consider will vary by resource.
- Consider providing a site-specific analysis of air quality impacts. The existing discussion tiers from the GEIS. The GEIS noted that the primary nonradiological emissions from in-situ recovery facilities include diesel combustion emissions from construction equipment (including drilling rigs) and fugitive dust emissions from vehicle travel on unpaved road. A site-specific analysis of fugitive dust emissions, well drilling emissions, construction equipment emissions, and reclamation equipment emissions should be conducted.
- Consider environmental justice in the ER. Executive Order 12898 requires Federal agencies to consider environmental justice in their NEPA reviews and NRC conducts such an analysis if an environmental impact statement is being prepared. To conduct such an analysis, the applicant needs to understand the distribution of minority and low-income populations within the area to assess whether there would be a disproportionately high and adverse impact to these populations.

- Consider the initiation of Traditional Cultural Property (TCP) surveys.

Other Observations:

- Please provide a schedule that shows the development of individual wellfields or production areas over time. To assess the environmental impact, NRC staff needs to understand the footprint of the activities that will occur since this will drive the impact analyses.
- Please provide a map that shows the detailed infrastructure (i.e., headerhouses, access roads, overhead lines, wellfields, central processing plant, storage areas etc.) and a table that summarizes the area(s) potentially disturbed (e.g., how many miles of new access road would be constructed and where would it be located?)
- How and where will chemicals be stored? How much will be stored at any given time?
- Please clarify the use of the surge ponds (i.e., will they also be used for evaporation?) and ensure their location is shown on a map.
- AUC discusses the potential use of wastewater tanks. Please show the proposed location and size of these tanks.
- The ER describes various facilities that could be used for disposal of anticipated byproduct material and other waste types. If the anticipated location is known, please provide it. Otherwise, NRC staff will select the most conservative location (e.g., the farthest away) to estimate impacts.
- Table 2-2 is a comparison of alternatives considered, but eliminated from detailed analysis. Quantify the impacts to the extent practicable based on site-specific information.
- The site encompasses part of the Thunder Basin National Grassland. Please ensure that AUC, LLC understands the implications of undertaking activities in such a designated area.
- Please ensure the transportation analysis also considers the volume and frequency of chemical supply shipments.
- Please provide the official wetlands determination from the U.S. Army Corps of Engineers (USACE) once it is received.

Editorial Observations:

- This SEIS tiers from the GEIS. Please ensure the correct geographic region from the GEIS is referenced (Wyoming East Uranium Milling Region).
- Please clarify whether the Belle Fourche River is classified as perennial.
- Please confirm the location of the nearest resident and make sure that it is consistent throughout the document.
- Please ensure that byproduct material is referenced correctly.
- Please clarify whether two or four deep disposal wells are proposed for management of liquid effluent.

ACTIONS:

1. NRC to identify the requirements/guidance for surge ponds and provide to AUC LLC.
2. NRC to clarify the number of copies of the license application that will be needed.
3. NRC to clarify how to submit information that an applicant would like to withhold from public disclosure (i.e., what is the correct format?)
4. NRC to copy AUC LLC on the preaudit letter that will be signed out by Larry Camper, Director, Division of Waste Management and Environmental Protection, and distributed to potentially interested tribes.

ATTACHMENTS

1. Agenda
2. List of Attendees
3. Groundwater Modeling Presentation
4. Site Tour Information

ATTACHMENT 1

MEETING AGENDA

AUC, LLC Reno Creek In Situ Recovery Facility
Site Visit and Pre-Submission Application Review
November 15 – 17, 2011
Wright, Wyoming

November 15, 2011

Time	Topic	Speaker
8:00 a.m.	Introduction	NA
8:30 a.m.	Site Visit	AUC
11:00 a.m.	Application Review	NRC Staff
4:00 p.m.	Adjourn	

November 16, 2011

Time	Topic	Speaker
8:00 a.m.	Application Review	NRC Staff
4:00 p.m.	Adjourn	

November 17, 2011

Time	Topic	Speaker
8:00 a.m.	Application Review	NRC Staff
10:30 a.m.	Review Debrief	NRC Staff
11:30 p.m.	Opportunity for Questions from Public	NA
12:00 p.m.	Meeting Closed	NA

ATTACHMENT 2

MEETING ATTENDEES

Date: November 15 – 17, 2011

Wright Hotel, Wright, WY

8:00 a.m. to 5:00 p.m.

Topic: AUC LLC, Reno Creek In Situ Recovery Facility, Pre-submission Audit

NAME	AFFILIATION
Stephen J. Cohen	USNRC
Elise A. Striz	USNRC
Chris Puglsey	Thompson & Simmons
Hal Demuth	Petrotek
Errol Lawrence	Petrotek
Aaron Payne	Petrotek
Philip N. Cavendor	AUC LLC
James Webb	USNRC
Patti Swain	USNRC
Dan Dowers	AUC LLC
Jim Viellenave	AUC LLC
Anthony Thompson	Thompson & Pugsley
Leland Huffman	AUC LLC
Jim Yocum	TREC
Wendy Stransbury	TREC
Renaldo De Luna	TREC
Robert Meyer	TetraTech
Justin Scott	AUC LLC

ATTACHMENT 3

GROUNDWATER FLOW MODEL PRESENTATION

ATTACHMENT 4

SITE TOUR INFORMATION