



May 5, 2020

Mike LaFranzo
Senior Health Physicist
Region III – Division of Nuclear Materials and Safety
US Nuclear Regulatory Commission
2443 Warrenville Road, Suite 210
Lisle, IL 60532-4352

Re: Response to acceptance review of decommissioning plan submitted in accordance with 10 CFR 30.36(g) under License No. 24-00513-32, Mail Control No. 596692.

Dear Mr. LaFranzo:

In the US NRC letter dated March 12, 2020, in order to complete the acceptance review, NRC requested additional information on several issues. These questions were previously raised verbally during the onsite visit on February 25, 2020. Please find attached responses to two of the three specific areas where the Commission requested additional information. The University of Missouri's (MU) response also addresses the additional topics raised by the NRC.

However, do note that the Licensee is unable to complete the work required to respond fully to the third item due to complications related to COVID-19. As noted in our response, the Licensee is requesting, per 10 CFR 30.36(i)(5), an extension of 150 days from the date campus is officially reoccupied due to factors beyond the licensee's control. Per your suggestion during our April 29 phone conversation, due to the fluidity of the COVID-19 pandemic, the licensee would like to reserve the right to make a second extension request should new factors beyond our control arise. We appreciate the NRC's consideration of this extension.

If you have any questions, please do not hesitate to contact me by phone at (573) 882-7018 or via email at houtst@missouri.edu.

Sincerely,

Todd Houts
Director

cc: Cade Register, pending RSO, MU Environmental Health & Safety

encl: Attachment 1: MU Response to NRC Acceptance Review (Pickard Hall DP)
Attachment 2: ES&S Hydrology Report
Attachment 3: NRC Correspondence (March 12, 2020)

Attachment 1:
MU Response to NRC Acceptance Review
(Pickard Hall DP)

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MU Response to NRC Acceptance Review (Pickard Hall DP)
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During discussions on February 25, 2020 at the University of Missouri (MU), the licensee committed to provide additional information related to the Pickard Hall Decommissioning Plan as delineated in the NRC summary letter of the meeting, dated March 12, 2020. The following are MU responses to the NRC's request for additional information (RAI).

1. Request from the US NRC: Title 10 of the Code of Federal Regulations (CFR) 30.36(g)(4) states, in part, that a decommissioning plan shall include a description of the conditions of the site or separate building or outdoor area sufficient to evaluate the acceptability of the plan.

Within the Decommissioning Plan, the licensee had not provided adequate information on conditions or radiological contamination that either has or could enter the ground water system. This information is to include, but not limited to, ground water direction, flow rates, potability, soil conditions near the groundwater table, and radiological transport to potential receptors by way of groundwater flow.

Response from the University of Missouri:

MU requested and received hydrology information from the firm Engineering Surveys & Services (ES&S) located in Columbia, MO who summarized hydrology information from their field logs of borings near Pickard Hall. Specifically, two borings were located between Pickard Hall and the Journalism Building to the north. Other borings were located on the northern side of the Journalism Building.

MU requested information on the following parameters and descriptions of the soils:

For Each Unsaturated Zone:

- Thickness
- Soil Density
- Total Porosity
- Effective Porosity
- Field Capacity
- Hydraulic Conductivity
- b Parameter

For Saturated Zone:

- Density
- Total Porosity
- Effective Porosity
- Field Capacity
- Hydraulic Conductivity
- b Parameter
- Hydraulic Gradient
- Water Table Drop
- Direction of Groundwater Flow

ES&S was able to provide typical data ranges for each parameter except "b Parameter". The data provided is included in the attached ES&S letter. ES&S also presented a summary of the conditions of the soil, the groundwater, and the drinking water aquifer.

The information provided gives reasonable assurances that drinking water aquifers will not be affected by the limited amount of residual radioactivity at Pickard Hall, however, it does show that subsurface contamination (if present) has a low probability of migration via groundwater (perched water table) unless there is a preferential pathway such as pipe,

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conduit and the Steam Tunnel. Pipes, conduits, and anything man-made leaving the Pickard Hall site will be evaluated internally and externally to provide assurances that any residual radioactivity after demolition is either not present or below concentrations causing greater than 25 mrem/year dose to a member of the public as provided in NRC decommissioning guidance and standards.

2. Request from the US NRC: 10 CFR 30.36(g)(4) states, in part, that a decommissioning plan shall include a description of planned decommissioning activities. Within the Decommissioning Plan, the licensee had not provided adequate information on the waste disposal options and details to ensure waste had an appropriate location to be properly disposed in accordance with NRC regulations. This information is to include, but not limited to, the ultimate location waste is to be disposed and regulatory process for which the waste shall be transferred under. During the site visit on February 25, 2020, the NRC had noted that limited space is available in the general area of Pickard Hall to store waste prior to shipment without potentially impacting the surrounding area. In addition to the above information, the NRC is requesting the licensee provide details on how waste is to be stored prior to transport to an authorized waste disposal site and how such storage will or will not impact the immediate area. This evaluation should include impacts from environmental factors such as wind and rain.

Response from the University of Missouri: After further review, MU has determined that Waste Control Specialists (WCS) or EnergySolutions may be more cost-effective disposal options and do not require additional NRC approvals for alternate disposal. Pickard Hall radiological waste will be disposed at WCS in Andrews County, Texas or EnergySolutions in Clive, Utah.

Regarding the storage of radwaste containers on-site during demolition, waste containers will be live loaded directly onto trucks and typically not stored on-site. Live loading in this instance means waste containers (bags) will be placed into a frame on a truck and then loaded with waste. As soon as the bag is filled and manifested, it will be taken immediately to the local transload facility. There is a transload facility in Columbia, MO that can be used by the transporter to transfer the waste containers directly from truck to the railcar. Upon arrival the waste container will be removed from the truck and placed immediately into the railcar gondola shipping container. After filling the gondola container, the shipper will manifest the load for transport to the disposal facility.

In rare instances, there may be limited numbers of filled or partially filled radwaste bags stored on-site awaiting pickup by the transporter. Because there is limited room, MU and Chase do not plan on storing waste containers onsite unless it is only partially filled, and filling will be completed the following workday. In this instance, the bag will remain on the truck in the loading frame and the bag will be closed and/or tarped to prevent water intrusion.

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3. Request from the US NRC: Title 10 CFR 30.36(g)(4) states, in part, that a decommissioning plan shall include a description of the planned final radiation survey. Within the Decommissioning Plan, the licensee had not provided adequate information on its criteria to demonstrate the site could be released for unrestricted use once decommissioning was completed. This information is to include, but not limited to, soil release criteria, such as a Derived Concentration Guideline Level (DCGL), any supporting conceptual site model(s) [CSM(s)] for translating concentrations in soil/groundwater to dose, and the basis for parameter selection in the CSMs so that the NRC can make an evaluation of the CSM(s) and DCGL. Such an evaluation shall address all radionuclides of concern such as radium, thorium, and uranium.

Response from the University of Missouri:

MU is contracting Chase and a general contractor to perform additional subsurface characterization data under the Chase Decommissioning Radioactive Materials License by collecting subsurface soil samples around and under the building. The additional subsurface soil characterization data, along with the hydrology data gathered from ES&S, will be used to develop the conceptual site model (CSM) and to calculate derived concentration guideline levels (DCGLs) for each nuclide of concern.

MU is operating under an Official Directive from the President of the University of Missouri that no one may physically work on the MU campus until further notice due to the COVID-19 pandemic. Consequently, MU is unable to physically begin these activities.

Per 10 CFR 30.36(i)(5), the licensee is requesting the Commission approve an extension due to "...other factors beyond the control of the licensee", in this case delays related to the COVID-19 pandemic and its theoretically unknown endpoint.

Once the ban prohibiting occupancy on the campus is lifted, MU will invite contractors to visit the site and prepare bids for various portions of the work to be done. MU expects to award those contracts 30 days after the on-site visit. Once the contracts are awarded, MU expects the work will be completed within 105 days. The CSM could be developed (along with calculating the DCGLs) and a final report submitted to the Commission within another 15 days.

Therefore, the licensee is requesting 150 days from the date campus may be reoccupied to provide the Commission the data requested under this RFI. The licensee will notify the Commission of the approved date to reoccupy the campus once it is determined. However, due to the fluidity of the COVID-19 pandemic, including the possibility of a second wave of infections, the licensee would like to reserve the right to make a second extension request should new factors beyond our control arise.

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4. Additional Topics from the US NRC: In addition to the above information discussed during the site visit of February 25, 2020, the NRC also discussed issues concerning any technical review in the future. These included:
- Water control measures,
 - Decommissioning order of work, and
 - Controls for limiting exposure and contamination.

These three issues are to be considered topics and do not represent a full technical review of the Decommissioning Plan. The NRC reserves the right to request additional information at a future date. However, if you wish to address these topics, or any of the topics discussed at the meeting, at the same time as you address the previously identified information requested, it may prove to be beneficial by shortening the staff review of the decommissioning plan.

Response from the University of Missouri:

MU is providing responses to the additional topics as suggested.

- Water control measures,
- Decommissioning order of work, and
- Controls for limiting exposure and contamination.

Water Control Measures

The specifications developed for the demolition of Pickard will be developed with industry standard Best Management Practices incorporated. Regarding water control measures during demolition, there are several means and methods that can be employed as appropriate to control dust suppression and water run on and run off from the posted demolition area.

- Dust suppression for demolition is typically performed with a fan powered water mist to atomize the water to create a water mist envelope in the area of active demolition. The water misting equipment can be adjusted to minimize water usage and direction of created water mist. This can assist with the control/minimization of any dust suppression overspray. Additionally, a “Wind Curtain” can be erected in the posted demolition area to mitigate any fugitive or over sprayed dust suppression water.
- Dust suppression water can also be generated from a local hydrant and fog nozzle on a fire hose. This method can be used versus the previously identified misting equipment when continuous demolition activity is not ongoing. This method can greatly reduce the amount of water being used and direct the water fog directly onto the area being demolished.
- Water run on and run off from the posted demolition area can be minimized/prevented with the installation of soil berm inside silt fencing and/or an impermeable berm encompassing the posted demolition area. A soil berm can be used in areas where the elevation slopes towards Pickard Hall or is relatively flat, this

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will ensure that surface water flow will not enter the posted demolition area or leave the posted demolition area. If the elevation slopes away from the posted demolition area an impermeable berm may be necessary to avoid water from leaving the posted demolition area. Placement of the berms and other controls will be provided in the stormwater pollution and prevention plan and the project specifications.

Water is expected to be collected in the basement of Pickard Hall during the demolition activities. Prior to starting demolition, drains within and outside Pickard Hall will be sealed to prevent water from escaping the posted demolition area. Water will be collected and treated on site using mechanical filtration. Water collected and treated will be sampled prior to discharge. MU personnel will be the authorizing authority for the discharge of treated water.

Decommissioning Order of Work

The demolition of Pickard Hall will be permitted after the Decommissioning Plan is approved by the NRC. Pre-decommissioning activities will be conducted under the Chase decommissioning radioactive materials license and radiological work plan for source term reduction and to collect additional characterization data for building surfaces. Drain lines in the basement and several other structural areas within Pickard Hall will be remediated/removed to reduce the existing source term. Reducing the existing source term will minimize the risk of exposure to personnel, reduce the risk of contamination spreading outside the footprint of Pickard Hall, and allow for subsurface characterization of the soils below the basement slab.

Prior to performing pre-decommissioning activities, interfering materials will be removed. Existing asbestos material will be abated by a licensed asbestos abatement company and loose equipment, furnishings, and fixtures that meet the radiological release criteria may be removed from Pickard Hall.

Activities associated with the source term reduction and additional characterization are:

- Remove loose equipment, furniture, and fixtures throughout Pickard Hall
- Remove select stud/plaster walls in basement to allow characterization of original brick surfaces
- Prepare for concrete floor cutting by remediation of brick and concrete in basement
- Concrete cutting of basement floor to access/remove contaminated floor drain lines
- Collect soil samples below contaminated floor drain lines
- Core the basement floor slab and sample underlying soils
- Access and characterize/remediate windowsill in Room 213
- Remove insulation in the Attic to collect additional characterization data
- Perform GPS gamma scan of the surrounding grounds to Pickard Hall
- Perform GPS gamma scan of a background reference area

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- Collect subsurface soil samples from surrounding grounds
- Collect surface and subsurface soil samples from a background reference area
- Collect core samples from the 1st and 2nd floor walls and flooring
- Collect ventilation chimney measurements and samples

After the approval of the Decommissioning Plan, specifications for the demolition of Pickard Hall will be developed and provided to the demolition company for implementation. The active demolition area will be marked and barricaded to prevent unnecessary personnel from accidentally entering the area. A truck route for waste loading and transport off site will be established; if any additional traffic controls are required, they will be implemented.

Demolition debris will be loaded into IP-1 rated polypropylene bags in a frame on the truck designed for the transport of waste material. A transload facility will be established at a local rail spur. This transload facility will be surveyed prior to, during and after completing the demolition and soil removal activities associated with Pickard Hall to verify that no contamination was spread outside the waste packages.

Soil will be removed from under the basement floor based on the data collected during the previous actions. The soil will be scanned and sampled to ensure the DCGLs for the project are met. If additional soil needs to be removed, it will be removed and the scanning and sampling process will be repeated.

A Final Status Survey Report will be developed upon completing the remediation activities and submitted to MU and the NRC for review and acceptance. The site will be restored to the elevations provided by MU in the specifications and the restoration plan after concurrence from the NRC that the site is remediated to less than 25 mrem/year.

Controls for Limiting Exposure and Contamination

By reducing the existing source term in Pickard Hall and removing all loose equipment, furnishings, and fixtures that meet the radiological release criteria from the building prior to the start of demolition, the potential for spread of contamination and unnecessary personnel exposure is greatly diminished. The use of dust suppression during active demolition will minimize/limit the spread of airborne contamination.

To verify the effectiveness of the actions taken prior to the start of demolition, a rigorous air sampling regimen will be developed. It is anticipated that radon monitors and continuous air monitors for airborne particulates will be employed. Additionally, personal air monitors will be worn by select personnel with the highest potential for exposure. The resultant data will be used to verify the effectiveness of the engineering controls.

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Additionally, the use of daily contamination surveys around the site perimeter and inside the posted demolition area will alert the project team to any potential contamination issues. Collected data will be used to verify the effectiveness of the aforementioned actions and dust suppression; or provide evidence that additional measures need to be taken to minimize the spread of contamination inside/outside the posted demolition area.

The sealing of floor drains and exterior stormwater drains, while also utilizing industry standard Best Management Practices for stormwater pollution and prevention, will limit the spread of contaminated water or waterborne sediment.

Attachment 2:
ES&S Hydrology Report



Engineering Surveys & Services

Consulting Engineers, Land Surveyors, and Geoprofessionals
Analytical and Materials Laboratories

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Columbia, Missouri 65201
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March 11, 2020

Ms. Heiddi Davis, AIA
University of Missouri
General Services Building
Columbia, MO 65211

RE: Geotechnical Engineering
Pickard Hall
CP200331
Columbia, Missouri

Dear Ms. Davis:

We have reviewed our records for borings around Pickard Hall regarding the requested information from Mr. Dave Culp with Chase Environmental. Mr. Culp requested the following information:

For Each Unsaturated Zone:

- Thickness
- Soil Density
- Total Porosity
- Effective Porosity
- Field Capacity
- Hydraulic Conductivity
- b Parameter

For Saturated Zone:

- Density
- Total Porosity
- Effective Porosity
- Field Capacity
- Hydraulic Conductivity
- b Parameter
- Hydraulic Gradient
- Water Table Drop Rate
- Direction of Groundwater Flow

Our boring logs indicate that the soils surrounding Pickard Hall are primarily clay-rich glacial till with varying amounts of sand and silt. Interbedded within the till are sand lenses of varying thickness and lateral extent. Generally, groundwater encountered in the glacial till is considered perched groundwater and is associated with sand lenses or at the soil/rock interface. There is a MU water supply well in the area, MU Well #5 located approximately 0.7 miles to the southeast. It is our understanding that the aquifer is deep, between 1,300 and 1,400 feet, and water is produced out of the Cambrian-Ordovician dolomite aquifer, not surficial sand lenses.

Groundwater was encountered in several of the nearby borings at elevations ranging between 728 and 708 feet USGS, and as high as the 731 elevation when encountered in trace amounts in sand lenses. Generally, there is no defined phreatic surface and the volume of ground water is dependent on the thickness and lateral extent of the sand lenses. There may be some

interconnectivity between sand lenses through micro-fractures in the soil matrix as well as along utility tunnel backfill.

With regard to the above requested parameters:

Unsaturated Zone:

Thickness: This is variable; however, where groundwater is encountered there appears to be at least 12 to 14 feet of unsaturated material above the perched water.

Soil Density: Previous samples ranged between 99 and 107 pounds per cubic foot (pcf), dry unit weight. Soil moisture contents ranged between 20 to 25 percent.

Total Porosity: Samples from this area had a total porosity ranging between 0.3 and 0.4 cc/cc based on soil specific gravities ranging between 2.65 and 2.71

Effective Porosity: Samples from this area had a total porosity ranging between 0.31 and 0.35 cc/cc based on soil specific gravities ranging between 2.65 and 2.71

Field capacity: Generally, in the glacial soils the field capacity will run in the 0.3 to 0.4 cm³ water/cm³ soil range¹; however, in fat clays with clay contents above 60% and low sand content the field capacity can get into the 0.5 cm³ water/cm³ soil range.

Hydraulic Conductivity: Depending on the Clay/Sand/Silt proportions of the soil matrix, the hydraulic conductivity of the glacial till generally fall between 1E⁻⁵ to 1E⁻⁸ cm/sec

b Parameter: Unknown

Saturated Zone:

Density: Previous samples were around 115 pounds per cubic foot (pcf), dry unit weight. Soil moisture contents ranged between 15 and 19 percent.

Total Porosity: Samples from this area had a total porosity ranging between 0.3 and 0.4 cc/cc based on soil specific gravities ranging between 2.65 and 2.71

Effective Porosity: Samples from this area had a total porosity ranging between 0.31 and 0.35 cc/cc based on soil specific gravities ranging between 2.65 and 2.71

Field Capacity: See field capacity above.

Hydraulic Conductivity: New sample and tests required for this. This would be of the clay matrix. Since most of the groundwater flow would be through the sand lenses, monitoring wells and drawdown tests would be required to obtain the actual flow through the sand lenses.

b Parameter: Unknown

Hydraulic Gradient: Since most of the groundwater is perched, a true groundwater table does not exist. Due to the groundwater being associated with sand lenses at various elevations or with the soil/rock interface, it would be difficult to determine the Hydraulic Gradient. Groundwater may also flow through fractures in the rock matrix.

Direction of Groundwater Flow: Difficult to determine with perched groundwater since the sand lenses can be at various elevations.

Water Table Drop Rate: Monitoring wells would be required and may not be viable with perched water. Limited lateral extent and recharge rates.

I have included copies of the laboratory results and boring logs for work that we have done nearby.

After my telephone conversation with Mr. Culp, the above parameters along with the knowledge that the groundwater encountered in the Pleistocene glacial soils is not used for drinking in this area, should provide enough information to run the contaminant transport analysis. It is also our understanding that an additional subsurface investigation may be required for contaminant analysis. At that time, we would be delighted to discuss with you and Mr. Culp procedures to obtain any additional geotechnical or hydrologic information that may be required for analysis.

Sincerely,



Randall A. Lee, PE, RG

Enclosures

cc: Davis

¹ Field capacity determined from a "Soil Texture Triangle – Hydraulic Properties Calculator" developed by Dr. K. E. Saxton, USDA/ARS, Pullman, WA 99164-6120. Calculator web site location: <https://resources.hwb.wales.gov.uk/VTC/env-sci/module2/soils/soilwatr.htm>

LAB NO. 9309
 PROJECT: Donald W. Reynolds Journalism
Columbia, Missouri
 SUMMARY OF
 LABORATORY TEST RESULTS

BORING NO.	SAMPLE NO.	DEPTH (FEET)	USCS CLASS	NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (PCF)	ATTERBERG LIMITS			UNCONFINED COMPRESSION		REMARKS
						LL	PL	PI	COHESION (TSF)	STRAIN %	
B1	SS1	2.0-4.0		21							
	SS2	9.0-10.0	CH	24		56	14	42			
	ST3	11.1-11.6		23	105				0.5	3.1	TV = 0.8 tsf, PP = 1.5 tsf
	SS4	12.0-15.0		18							
	AS6	19.2-21.0		29							
B2	SS1	0.2-2.0		16							
	SS3	8.0-9.0		17							
	ST4	12.3-12.8	CH	20	107	50	14	36	0.9	2.4	
	SS5	14.0-17.0		20							
B3	SS1	1.0-2.0		15							
	ST2	2.2-2.7	CL	19	102	31	13	18	0.8	3.9	TV = 1.1 tsf, PP = 2.5 tsf
	SS4	7.5-9.0		17							
	ST5	12.5-13.0		15	98				0.9	3.5	TV = 1.0 tsf, PP = 3.5 tsf
B4	SS1	1.5-3.0		26							
	SS2	6.0-8.0		23							
	ST3	10.8-11.3	CL	15	115	25	10	15	0.3	3.9	TV = 0.3 tsf, PP = 1.25 tsf
	SS4	14.0-17.0		20							
	AS6	23.0-25.0		22							
B5	SS1	1.0-2.0		22							
	SS2	5.0-7.0		24							
	SS3	10.0-12.0	CL	19		45	13	32			
	SS4	12.0-13.0	CL-ML	21		21	16	5			
	ST5	14.1-14.6		17	115				0.8	2.4	PP = 4.5+ tsf
	SS6	14.6-16.1		16							
	SS8	25.0-26.0		18							

LAB NO. 9309
 PROJECT: Donald W. Reynolds Journalism
Columbia, Missouri
 SUMMARY OF
 LABORATORY TEST RESULTS

BORING NO.	SAMPLE NO.	DEPTH (FEET)	USCS CLASS	NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (PCF)	ATTERBERG LIMITS			UNCONFINED COMPRESSION		REMARKS
						LL	PL	PI	COHESION (TSF)	STRAIN %	
B6	SS1	1.0-3.0		18							
	ST2	6.0-6.5		23	105				0.8	3.0	TV = 0.5 tsf, PP = 1.75 tsf
	ST3	11.0-11.5		25	99				0.5	2.7	TV = 0.9 tsf, PP = 2.5 tsf
	SS4	13.0-15.0		19							
	SS6	19.0-20.5		23							
	SS7	25.0-26.5		19							
B7	ST1	5.5-6.0		23	105				0.4	3.5	TV = 0.4 tsf, PP = 1.5 tsf
	ST3	12.0-12.5	CL	20	107	44	12	32	1.2	10.1	TV = 1.6 tsf, PP = 3.0 tsf
	SS4	13.0-14.5		18							
	ST5	18.7-19.0									PP = 4.5+ tsf
	SS6	19.0-20.5		10							

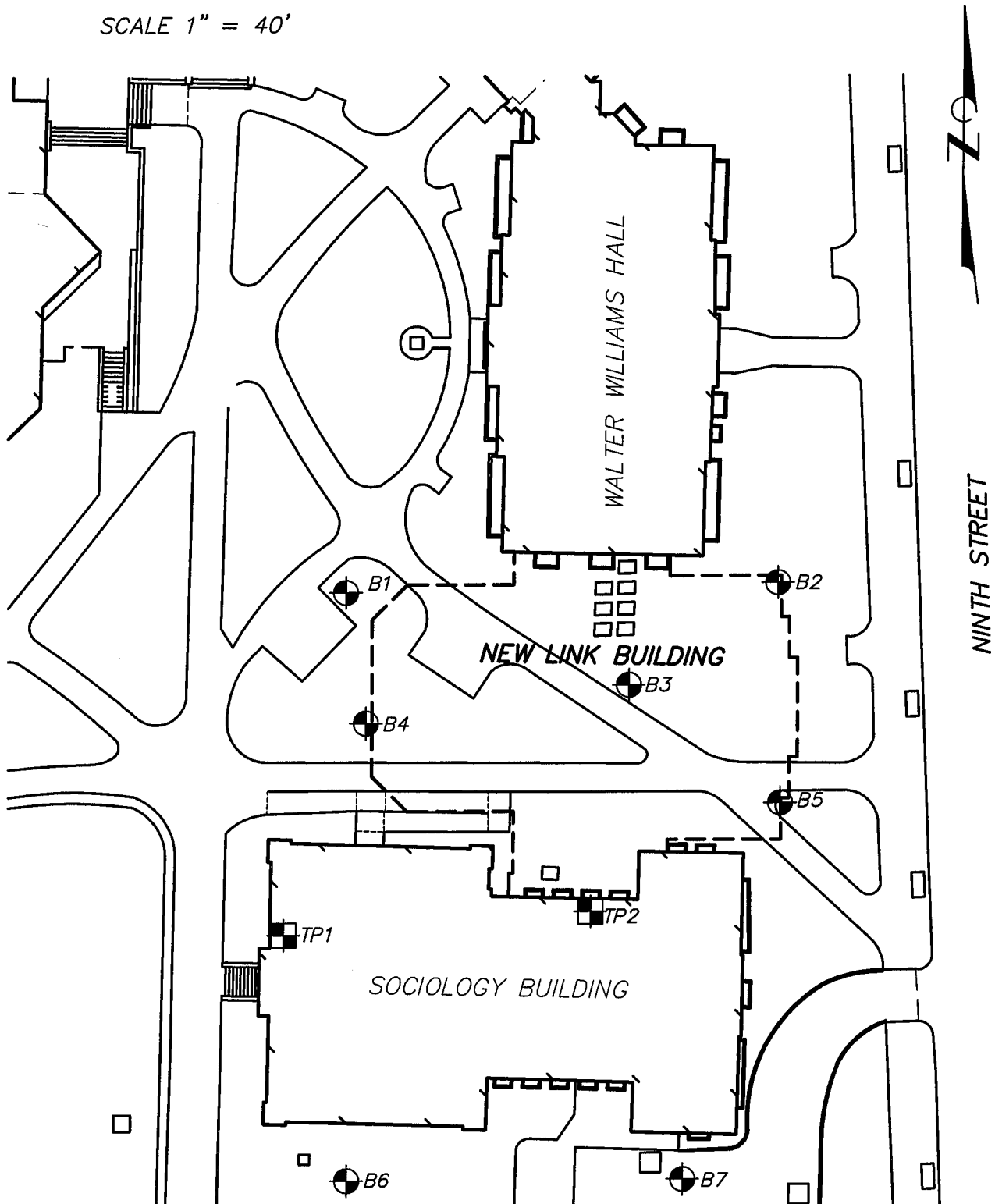
TV = Hand Held Torvane PP = Pocket Penetrometer

LAB NO. 9309

PROJECT: *Donald W. Reynolds Journalism
Columbia, Missouri*

PLAN OF
BORING LOCATIONS

SCALE 1" = 40'



LAB NO. 9309LOG OF BORING NO. B1PROJECT: *Donald W. Reynolds Journalism
Columbia, Missouri*TYPE: *4" Solid Stem Auger*

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION TYPE, COLOR, MOISTURE & OTHER LOCATION: <i>See Plan of Boring Locations</i> SURF. ELEV.: 740.6'	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.	COHESION, TON/SQ.FT. ⊗						
						0.2	0.4	0.6	0.8	1.0	1.2	1.4
						PLASTIC LIMIT + - - - - +	WATER CONTENT, % - - - - -		LIQUID LIMIT - - - - - +			
						10	20	30	40	50	60	70
		TOPSOIL: CLAYEY SILT, Dark brown, moist, firm, roots										
		SILTY CLAY: Brown with some gray, moist, firm, root hairs										
5		-; gray with orangish brown, with sand										
		-; gray sand patches, trace of gravel										
10		SILTY CLAY: Gray with orangish brown, moist, firm, roots, with gray patches of sand, chert gravel		CH	105	+	•	- - - - -	- - - - -	+		
		SANDY SILTY CLAY: Light brown with orangish brown, moist, firm										
15		SANDY SILTY CLAY: Orangish brown with greenish gray, moist, firm, with small chert gravel										
		SILTY CLAY: Brown, moist, firm, small chert and limestone gravel, with sand										
20		LIMESTONE: Cobble										
		CLAYEY SHALE: Dark gray, moist, firm										
25		SHALE: Dark gray, damp, hard										
		LIMESTONE: Thin bed or cobble										
		SHALE: Black, damp, stiff										
		-; dark gray										
30		-; gray, trace of sand										
		-; light gray, dry										
35		SHALE: Greenish gray, moist, firm										
		LIMESTONE: Hard										
			100									
40		SHALE: Dark gray, damp, stiff, with some limestone and chert gravel										
45		LIMESTONE: Hard, light gray										
50												

Completion Depth: 43.7'
Date: 11 June 2004Depth to Water: 25.0'
Date: 11 June 2004

LAB NO. 9309LOG OF BORING NO. B2PROJECT: *Donald W. Reynolds Journalism
Columbia, Missouri*TYPE: *4" Solid Stem Auger*

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION TYPE, COLOR, MOISTURE & OTHER LOCATION: <i>See Plan of Boring Locations</i> SURF. ELEV.: 742.8'	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.	COHESION, TON/SQ.FT. 0.2 0.4 0.6 0.8 1.0 1.2 1.4						
						PLASTIC LIMIT + - - - - +			WATER CONTENT, % - - - - -		LIQUID LIMIT - - - - - +	
						10	20	30	40	50	60	70
	X	TOPSOIL: CLAYEY SILT, Brown, moist, firm, roots					●					
5		CLAYEY SILT: Brown with dark brown mottled red, moist to damp, firm, roots										
	X	SANDY SILTY CLAY: Orangish brown and gray, moist, firm, roots -; orangish brown, gray sand patches, medium size gravel -; cobble					●					
10		SANDY SILTY CLAY: Light brown, moist, hard, chert gravel		CH	107	+	●	-	-	-	⊗	-
15	X	SILTY CLAY: Brown with yellowish and orangish brown, moist, firm, gray sand patches					●					
20		SHALEY CLAY: dark greenish gray and black, moist, firm										
		LIMESTONE: Hard, beige										
25												
30												
35												
40												
45												
50												

Completion Depth: 21.5'
Date: 10 June 2004Depth to Water: Not Encountered
Date: 10 June 2004

LAB NO. 9309LOG OF BORING NO. B3PROJECT: *Donald W. Reynolds Journalism
Columbia, Missouri*TYPE: *4" Solid Stem Auger*

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION TYPE, COLOR, MOISTURE & OTHER LOCATION: <i>See Plan of Boring Locations</i> SURF. ELEV.: 742.1'	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.	COHESION, TON/SQ.FT.							
						0.2 0.4 0.6 0.8 1.0 1.2 1.4							
						PLASTIC LIMIT	WATER CONTENT, %				LIQUID LIMIT		
						+	—	—	—	—	+	+	+
						10	20	30	40	50	60	70	
	X	TOPSOIL: CLAYEY SILT, Dark brown, moist, firm					●						
		CLAYEY SILT: Brown with dark brown, moist, firm, trace of gravel		CL	102	+	●	—	+	—	—		
5		SILTY CLAY: Gray with traces of brown, moist, firm, gray sand patches											
	X	SANDY SILTY CLAY: Gray with traces of brown, moist, firm, traces of gravel					●						
10		—; orangish brown, with gray sand patches											
		SANDY SILTY CLAY: Light brown with gray, moist to damp, firm to stiff			98		●		—	—	—		
15		—; cobble											
		—; chert cobble											
		—; brown, with small gravel											
20		—; chert cobble											
		SANDY SILTY CLAY: Light brown with orangish and reddish brown, moist, stiff, with some gravel											
		—; with dark gray, somewhat shaley											
25		LIMESTONE: Thin bed											
		SHALE: Black, wet, soft											
30													
		SANDY SHALE: Gray, dry, hard											
		LIMESTONE: Thin bed											
35		CLAYEY SHALE: Gray, dry, hard, trace of sand											
		LIMESTONE: Thin bed											
40													
		SHALE: Greenish gray, dry, hard, trace of sand											
45													
		LIMESTONE: Hard											
50													

Completion Depth: 44.6'
Date: 10 June 2004Depth to Water: Trace at 17.0' Depth at 22.0'
Date: 10 June 2004

LAB NO. 9309LOG OF BORING NO. B4PROJECT: *Donald W. Reynolds Journalism
Columbia, Missouri*TYPE: *4" Solid Stem Auger*

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION TYPE, COLOR, MOISTURE & OTHER LOCATION: <i>See Plan of Boring Locations</i> SURF. ELEV.: 741.2'	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.	COHESION, TON/SQ.FT. ⊗							
						0.2	0.4	0.6	0.8	1.0	1.2	1.4	
						PLASTIC LIMIT + - - - - +	WATER CONTENT, % - - - - - ● - - - - -				LIQUID LIMIT - - - - - +		
						10	20	30	40	50	60	70	
		TOPSOIL: CLAYEY SILT, Dark brown, moist, firm, roots											
		SILTY CLAY: Brown with some gray, moist, firm, with sand											
5		-; gray with traces of orangish brown, traces of gravel											
		-; brown and orangish brown											
10		SANDY SILTY CLAY: Gray with orangish brown, moist, firm, trace of gravel, medium grain sand		CL	115								
		-; light brown and orangish brown											
15		-; with gray, moist, soft to firm, fine grain sand, chert gravel											
		SHALEY CLAY: Light brown and greenish gray, moist, firm											
20		-; wet to moist, soft to firm, trace of sand											
		CLAYEY SHALE: Orangish brown, with reddish brown, and traces of black, wet to moist, soft to firm											
25		SHALE: Black, damp, hard											
		-; dark gray											
		-; dry											
30		SHALE: Light gray, moist, firm											
		LIMESTONE: Thin bed or cobble											
35		SHALE: Dark gray, damp, firm, firm, trace of gravel											
		-; limestone cobble											
		LIMESTONE: Hard											
40													
45													
50													

Completion Depth: 37.7'
Date: 11 June 2004Depth to Water: Trace at 14.0' Depth at 33.0'
Date: 11 June 2004

LAB NO. 9309

LOG OF BORING NO. B5

PROJECT: Donald W. Reynolds Journalism
Columbia, Missouri

TYPE: 4" Solid Stem Auger

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION TYPE, COLOR, MOISTURE & OTHER See Plan of Boring Locations LOCATION: SURF. ELEV.: 743.3'	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.	COHESION, TON/SQ.FT.						
						0.2 0.4 0.6 0.8 1.0 1.2 1.4						
						PLASTIC LIMIT	WATER CONTENT, %			LIQUID LIMIT		
						+	---	---	---	---	---	+
						10	20	30	40	50	60	70
	X	TOPSOIL: CLAYEY SILT, Dark brown, moist, firm										
	X	SANDY SILTY CLAY: Brown, moist, firm										
5	X	-; orangish brown and gray, roots, trace of gravel, fine gray sand patches, moist, firm										
10	X	-; slightly shaley, firm to stiff		CL								
	X	CLAYEY SAND: Brown, wet, soft, fine to medium grain sand		CL-ML								
15	X	SANDY SILTY CLAY: Orangish brown with blueish gray, moist to damp, stiff	27		115							
20			100									
		SAND: Brown, soft, wet, medium grain										
		SANDY SILTY CLAY: Orangish brown and gray, moist, firm										
25	X	CLAYEY SAND: Light brown, wet, soft, fine grain	71									
		SANDY SILTY CLAY: Orangish brown										
30		CLAYEY SHALE: Dark gray with blueish gray, damp, hard										
		LIMESTONE: Hard										
35												
40												
45												
50												

Completion Depth: 26.1'
Date: 10 June 2004Depth to Water: Trace at 12.0' Depth at 15.0'
Date: 10 June 2004

LAB NO. 9309LOG OF BORING NO. B6PROJECT: *Donald W. Reynolds Journalism
Columbia, Missouri*TYPE: *4" Solid Stem Auger*

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION TYPE, COLOR, MOISTURE & OTHER LOCATION: <i>See Plan of Boring Locations</i> SURF. ELEV.: 741.3'	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.	COHESION, TON/SQ.FT.						
						0.2	0.4	0.6	0.8	1.0	1.2	1.4
						PLASTIC LIMIT +-----+	WATER CONTENT, % -----●-----			LIQUID LIMIT -----+-----		
						10	20	30	40	50	60	70
	X	TOPSOIL: CLAYEY SILT, Dark brown, moist, firm, roots, with small gravel					●					
5		SILTY CLAY: Light brown with orangish brown and some gray, moist, firm, with small to medium gravel, and brick fragments, root hairs			105		●		⊗			
10		SANDY SILTY CLAY: Brown with orangish brown, moist, firm -; wet to moist, soft to firm			99				⊗			
	X	SILTY CLAY: Brown with orangish brown, moist, firm					●					
15		SANDY SILTY CLAY: Dark gray with brown and orangish brown, moist, firm, medium grain sand, traces of gravel										
20	X	SANDY SILTY CLAY: Light brown with yellowish brown and gray, moist, soft to firm, with gravel	33				●					
25	X	CLAYEY SAND: Light brown, soft, wet, with gravel, medium to fine grain sand -; with black patches -; limestone cobbles, beige	42				●					
30		SHALEY CLAY: Gray, damp, stiff CLAYEY SHALE: Gray and greenish gray, damp, stiff LIMESTONE: Thin bed										
35												
40		SHALE: Dark gray, damp, stiff										
45		LIMESTONE: Hard										
50												

Completion Depth: 43.5'
Date: 11 June 2004Depth to Water: Depth at 15.0'
Date: 11 June 2004

LAB NO. 9309LOG OF BORING NO. B7PROJECT: *Donald W. Reynolds Journalism
Columbia, Missouri*TYPE: *4" Solid Stem Auger*

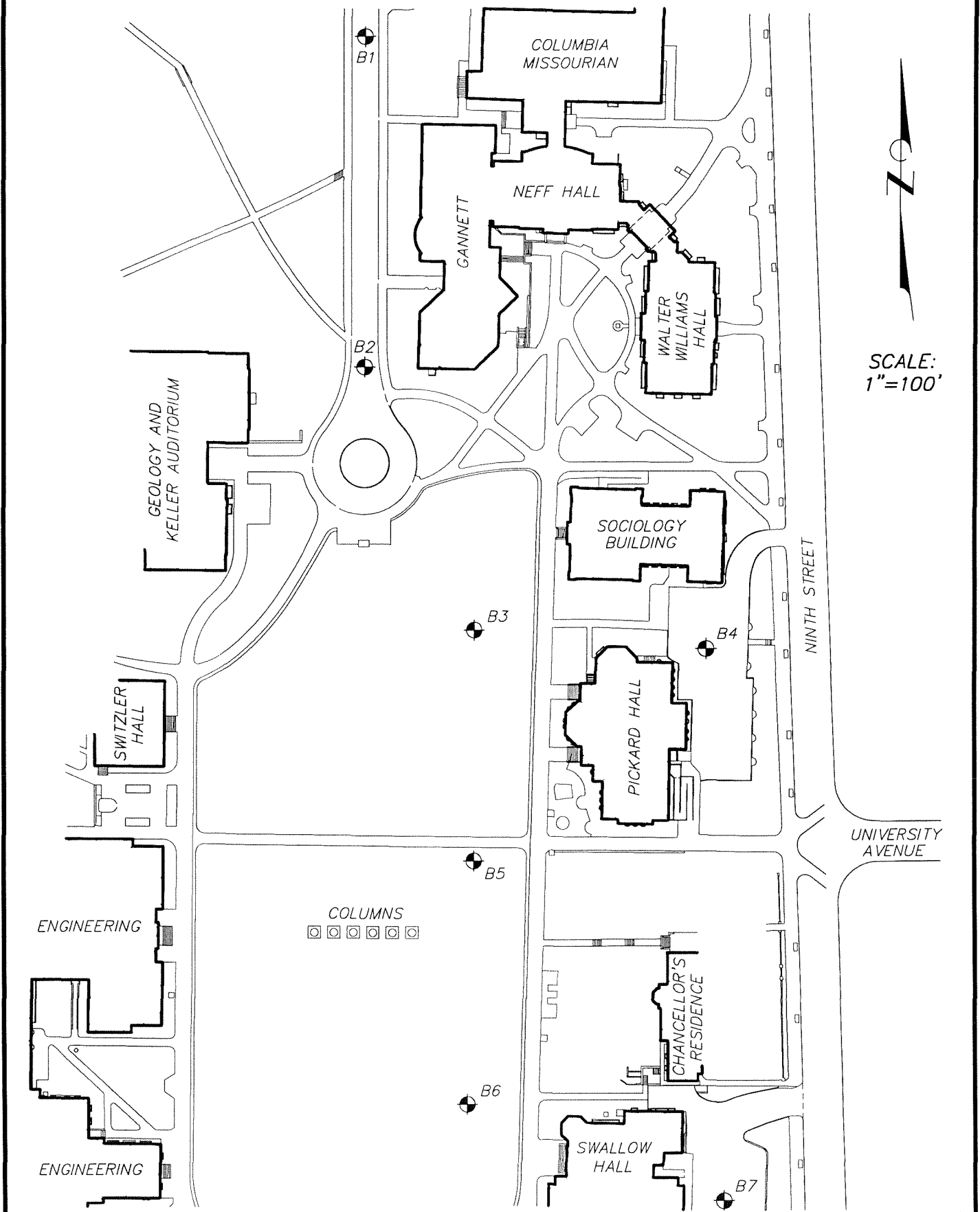
DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION TYPE, COLOR, MOISTURE & OTHER LOCATION: <i>See Plan of Boring Locations</i> SURF. ELEV.: 742.1'	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.	COHESION, TON/SQ.FT.						
						0.2	0.4	0.6	0.8	1.0	1.2	1.4
						PLASTIC LIMIT +-----+	WATER CONTENT, % -----●-----			LIQUID LIMIT -----+-----		
						10	20	30	40	50	60	70
		ASPHALT										
		WASTELIME										
5		CLAYEY SILT: Dark brown, moist, soft, to firm			105		⊗	●				
10		SANDY SILTY CLAY: Blueish gray with orangish brown, moist, firm										
		-; some fine grained gray sand, and small gravel										
		-; orangish brown and gray	16	CL	107	+	●			+	⊗	
15		-; cobble					●					
		-; dark gray										
		-; cobble										
20		SANDY SILTY CLAY: Dark gray and brown, damp, hard, fine grain, gray sand lenses	88			●						
		SANDY SHALEY CLAY: Dark gray, damp, hard	81									
25		LIMESTONE: Thin bed or cobble										
		SANDY SHALEY CLAY: Dark gray, damp, hard										
		SAND: Brown, wet, firm, medium grain										
30		SHALE: Gray with light gray, damp, hard										
		LIMESTONE: Thin bed										
35		SHALE: Gray, damp, hard										
		LIMESTONE: Hard										
40												
45												
50												

Completion Depth: 37.5'
Date: 10 June 2004Depth to Water: Depth at 18.0'
Date: 10 June 2004

LAB NO. 6284
PROJECT:

Francis Quadrangle
Below Grade Improvements #960405
Columbia, Missouri

PLAN OF BORING LOCATIONS



LAB NO. 6284

LOG OF BORING NO. B1

PROJECT: Francis Quadrangle - Below Grade Improvements #960405
Columbia, Missouri

TYPE: 4" Solid Stem Auger
with Drag Bit

DEPTH, FT.	SAMPLE	SAMPLE NO.	BLOWS PER FT.	SOIL DESCRIPTION
				TYPE,COLOR,MOISTURE & OTHER
				LOCATION: See Boring Plan SURF. ELEV.: 725.1
				ASPHALT
				CONCRETE
				FILL: Silty clay, dark brown, moist, firm
5				-; dark brown, with brick fragments, moist
10				-; with cobbles
				SHALEY CLAY: Light brown and gray, moist, firm
15				
				WEATHERED SHALE: Gray, damp, hard
20				-; with some moisture, with limestone cobbles
				WEATHERED LIMESTONE: Light gray, dry
				LIMESTONE
25				AUGER REFUSAL
30				

Completion Depth: 21.8'
Date: 15 August 1997

Depth to Water: Not Encountered
Date: 15 August 1997

LAB NO. 6284 LOG OF BORING NO. B2
 PROJECT: Francis Quadrangle - Below Grade Improvements #960405
 Columbia, Missouri TYPE: 4" Solid Stem Auger
 with Drag Bit

LOG OF BORING NO. B2

TYPE: 4" Solid Stem Auger
with Drag Bit

DEPTH, FT.	SAMPLE	SAMPLE NO.	BLOWS PER FT.	SOIL DESCRIPTION	
				TYPE,COLOR,MOISTURE & OTHER	LOCATION: See Boring Plan SURF. ELEV.: 733.1
				ASPHALT	
				CONCRETE	
				FILL: Silty clay, dark brown, moist, firm	
				SILTY CLAY: Brown, moist, firm	
5				-; brown with some gray, sandy	
10				-; mostly brown, with cobbles	
				-; with fine gravel	
15				COAL LAYER: Black, soft	
				SHALEY CLAY: Light brown and gray, moist. firm	
20				WEATHERED SHALE: Gray, damp, very stiff	
				-; hard with limestone cobbles	
25					
30					

Completion Depth: 25.0'
Date: 15 August 1997

Depth to Water: Not Encountered
Date: 15 August 1997

LAB NO. 6284PROJECT: Francis Quadrangle - Below Grade Improvements #960405
Columbia, MissouriLOG OF BORING NO. B3TYPE: 4" Solid Stem Auger
with Drag Bit

DEPTH, FT.	SAMPLE	SAMPLE NO.	BLOWS PER FT.	SOIL DESCRIPTION
				TYPE,COLOR,MOISTURE & OTHER
				LOCATION: See Boring Plan SURF. ELEV.: 739.7
				TOPSOIL: Silty clay, brown, moist, firm, root matter
5				FILL: Silty clay, dark brown, moist, firm, brick fragments
10				
15				SILTY CLAY: Dark brown, moist, firm
				SANDY CLAY: Brown, moist, fir, with lignite free water
				SAND
20				SILTY CLAY: Brown, moist, firm
25				
30				

Completion Depth: 25.0'
Date: 15 August 1997Depth to Water: 16.0'
Date: 15 August 1997

LAB NO. 6284 LOG OF BORING NO. B4
PROJECT: Francis Quadrangle - Below Grade Improvements #960405
Columbia, Missouri TYPE: 4" Solid Stem Auger
with Drag Bit

LAB NO. 6284 LOG OF BORING NO. B4
PROJECT: Francis Quadrangle - Below Grade Improvements #960405
Columbia, Missouri TYPE: 4" Solid Stem Auger
with Drag Bit

LAB NO. 6284 LOG OF BORING NO. B4
PROJECT: Francis Quadrangle - Below Grade Improvements #960405
Columbia, Missouri TYPE: 4" Solid Stem Auger
with Drag Bit

LAB NO. 6284 LOG OF BORING NO. B4
PROJECT: Francis Quadrangle - Below Grade Improvements #960405
Columbia, Missouri TYPE: 4" Solid Stem Auger
with Drag Bit

DEPTH, FT.	SAMPLE	SAMPLE NO.	BLOWS PER FT.	SOIL DESCRIPTION	
				TYPE,COLOR,MOISTURE & OTHER	
				LOCATION: See Boring Plan SURF. ELEV.: 742.4	
				ASPHALT	
				BASEROCK: 3/4" top size, well graded	
				FILL: Silty clay, brown, and tan, moist, firm, brick fragments	
5					
10				SILTY CLAY: Brown, moist, stiff, with sand	
15					
20				-; gray, moist, stiff, with fine gravel	
				-; with free water	
25					
30					

Completion Depth: 25.0'
Date: 15 August 1997

Depth to Water: 19.5'
Date: 15 August 1997

LAB NO. 6284 LOG OF BORING
PROJECT: Francis Quadrangle - Below Grade Improvements
Columbia, Missouri TYPE: 4" Solid

TYPE: 4" Solid Stem Auger
with Drag Bit

Engineering Surveys & Services
Columbia, Mo.

Attachment 3:
NRC Correspondence (March 12, 2020)



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
2443 WARRENVILLE ROAD, SUITE 210
LISLE, ILLINOIS 60532-4352

March 12, 2020

Todd Houts, Director
Environmental Health & Safety
Co-Director, MU Emergency Coordination
Curators of the University of Missouri - Columbia
c/o Gary Ward Vice Chancellor of Operations
900 East Stadium Blvd., Suite 180
Columbia, MO 65211

SUBJECT: CURATORS OF THE UNIVERSITY OF MISSOURI - COLUMBIA, ACCEPTANCE
REVIEW OF DECOMMISSIONING PLAN SUBMITTED IN ACCORDANCE WITH
10 CFR 30.36(g) UNDER LICENSE NO. 24-00513-32 (MAIL CONTROL
NUMBER 596692)

Dear Mr. Houts:

This letter is in response to your submittal of a Decommissioning Plan dated November 8, 2019, and our letter date January 6, 2020, (ML20006F926) acknowledging receipt of the Decommissioning Plan. Within our letter, we had stated that U.S. Nuclear Regulatory Commission (NRC) will perform an Acceptance Review of the submitted document prior to initiating our Technical Review.

Upon review, the NRC has determined that the following additional information is needed to complete our Acceptance Review prior to initiating our Technical Review. On February 25, 2020, the NRC and you and members of your staff and your consultants discussed this need for additional information at the Curators of the University of Missouri – Columbia campus. Below is the information requested:

1. Title 10 of the *Code of Federal Regulations* (CFR) 30.36(g)(4) states, in part, that a decommissioning plan shall include a description of the conditions of the site or separate building or outdoor area sufficient to evaluate the acceptability of the plan.

Within the Decommissioning Plan, the licensee had not provided adequate information on conditions or radiological contamination that either has or could enter the ground water system. This information is to include, but not limited to, ground water direction, flow rates, potability, soil conditions near the groundwater table, and radiological transport to potential receptors by way of groundwater flow.

2. 10 CFR 30.36(g)(4) states, in part, that a decommissioning plan shall include a description of planned decommissioning activities.

Within the Decommissioning Plan, the licensee had not provided adequate information on the waste disposal options and details to ensure waste had an appropriate location to

be properly disposed in accordance with NRC regulations. This information is to include, but not limited to, the ultimate location waste is to be disposed and regulatory process for which the waste shall be transferred under. During the site visit on February 25, 2020, the NRC had noted that limited space is available in the general area of Pickard Hall to store waste prior to shipment without potentially impacting the surrounding area. In addition to the above information, the NRC is requesting the licensee provide details on how waste is to be stored prior to transport to an authorized waste disposal site and how such storage will or will not impact the immediate area. This evaluation should include impacts from environmental factors such as wind and rain.

3. Title 10 CFR 30.36(g)(4) states, in part, that a decommissioning plan shall include a description of the planned final radiation survey.

Within the Decommissioning Plan, the licensee had not provided adequate information on its criteria to demonstrate the site could be released for unrestricted use once decommissioning was completed. This information is to include, but not limited to, soil release criteria, such as a Derived Concentration Guideline Level (DCGL), any supporting conceptual site model(s) [CSM(s)] for translating concentrations in soil/groundwater to dose, and the basis for parameter selection in the CSMs so that the NRC can make an evaluation of the CSM(s) and DCGL. Such an evaluation shall address all radionuclides of concern such as radium, thorium, and uranium.

To assist the licensee, the NRC has developed decommissioning guidance in the form of NUREG-1757 "Consolidated Decommissioning Guidance," Volumes 1, 2, and 3, which can be found on the NRC's public web site <https://www.nrc.gov/reading-rm/doc-collections/#nuregs>.

To ensure timely review of your Decommissioning Plan, please review the appropriate NRC guidance associated with the above Requests for Additional Information and provide as complete information as possible.

NRC is requesting that the information above be provided within 60 days of the date of this letter. If a response is not received within that time or the response is inadequate to initiate a Technical Review, the NRC shall consider whether additional actions are necessary.

In addition to the above information discussed during the site visit of February 25, 2020, the NRC also discussed issues concerning any technical review in the future. These included:

- Water control measures,
- Decommissioning order of work, and
- Controls for limiting exposure and contamination.

These three issues are to be considered topics and do not represent a full technical review of the Decommissioning Plan. The NRC reserves the right to request additional information at a future date. However, if you wish to address these topics, or any of the topics discussed at the meeting, at the same time as you address the previously identified information requested, it may prove to be beneficial by shortening the staff review of the decommissioning plan.

If you have any questions concerning the decommissioning process or the requirements for the decommissioning of your facility, you may contact Michael LaFranzo of the Materials Control, ISFSI, and Decommissioning Branch at 1-630-829-9865.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter will be available electronically for public inspection in the NRC's Public Document Room or from the NRC's Agencywide Documents Access and Management System (ADAMS), accessible from the NRC's website at <http://www.nrc.gov/reading-rm/adams.html>. If Security-Related Information is necessary to provide an acceptable response, please mark your entire response Security Related Information in accordance with 10 CFR 2.390(d)(1), follow the instructions for withholding in 10 CFR 2.390(b)(1) and provide a redacted copy so that the NRC can release as much information to the public as possible. In accordance with 10 CFR 2.390(b)(1)(ii), the NRC is waiving the affidavit requirements for your response.

Any correspondence regarding the decommissioning of your facility should reference the control number specified below, and your license number.

Sincerely,

/RA/

Michael M. LaFranzo, Senior Health Physicist
Materials Control, ISFSI, and
Decommissioning Branch
Division of Nuclear Materials Safety

Docket No. 030-02278
License No. 24-00513-32
Mail Control No. 596692

cc: Cade Register, Acting Radiation
Safety Officer

Letter to Todd Houts from Michael LaFranzo dated March 12, 2020.

SUBJECT: CURATORS OF THE UNIVERSITY OF MISSOURI - COLUMBIA, ACCEPTANCE
REVIEW OF DECOMMISSIONING PLAN SUBMITTED IN ACCORDANCE WITH
10 CFR 30.36(g) UNDER LICENSE NO. 24-00513-32 (MAIL CONTROL
NUMBER 596692)

DISTRIBUTION:

Darrell Roberts

John Giessner

David Pelton

Christine Lipa

ADAMS Accession Number: ML20078L134

OFFICE	RIII-DNMS	C	RIII-DNMS	C	HQ	C	HQ	C
NAME	MLaFranzo:brt		PLee		GChapman		BBolz	
DATE	3/12/2020		3/18/2020		3/11/2020		3/11/2020	
OFFICE	RIII-DNMS	C						
NAME	MKunowski							
DATE	3/18/2020							

OFFICIAL RECORD COPY