Introduction

This report is based on sound surveys conducted near the Sequoyah Nuclear Plant on Saturday, September 1, 1979, and on estimates of sound generated by major noise sources at the plant. Since construction activities were not taking place on this day, the data represent pre-operational sound levels at this time.

For purposes of this report we have assumed that both generating units would be operating and that the cooling towers would be operating continuously during the summer months. However, this is a multimode plant (open, helper, and closed modes) and we anticipate that in actual practice the plant will operate in open mode about 80 percent of the time, helper mode 16 percent, and closed mode about 4 percent of the time.

Noise-Sensitive Land Uses

Most of the land areas outside the plant boundary and within a one-mile radius of the plant appear to be rural residential or undeveloped water-front properties. There appear to be 20 to 30 homes within the one-mile radius. Some of these are on lakefront property.

Within the two-mile radius there are over 140 homes, one church, and a peninsula of Harrison Bay State Park. There are no schools or hospitals within the three-mile radius.

The nearest residential area to the plant transformers is along Igou Ferry Road west of the site. The nearest residence to the cooling towers seems to be on Chigger Point across the lake to the east.

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Preoperational Sound Survey

TVA conducted sound surveys at three selected community locations near the Sequoyah Nuclear Plant site on Friday, August 31, and Saturday, September 1, 1979. The locations of the sampling points are shown on Figure 1.

The August 31 survey data represent the sound environment during construction activities at the site. These data were not used in impact assessment.

The survey conducted on Saturday, September 1, 1979, provided data which can be used as preoperational or baseline data for impact assessment. No construction activity was in progress at the project on September 1.[1/] Thus the data represent current, typical summertime environmental sound values in the vicinity when no construction or production noise is occurring at the TVA plant site.

Tape recordings were made at each survey location. The time of day was randomly selected. Recordings lasted 15 minutes at each location. Both daytime (7 a.m. - 10 p.m.) and nighttime (10 p.m. - 7 a.m.) recordings were obtained for the preoperational sound surveys (September 1). Only daytime values were obtained for the construction sound surveys (August 31). Tapes were computer analyzed to yield equivalent sound levels for daytime periods (Ld), nighttime periods (Ln) and for the day-night composite (Ldn).[2/]

1/ The last work shift ended at 2300 hours, Friday, August 31, 1979. In order to avoid shift traffic noise, the baseline surveys did not start until 0015 hours, September 1, 1979.

2/ The instrumentation system used in measuring baseline noise levels consisted of a General Radio Model 1982 sound level meter and a Nagra model E single track, reel to reel, tape recorder.

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Footnote 2 continued:

The General Radio Model 1982 is a precision sound level meter and analyzer using a 1/2 inch flat random incidence microphone. The frequency range is from 10 HZ to 20 KHZ at the 3dB down points. This instrument meets the Ansi Standard S1.4-1971 for a type 1 instrument. The signal output of the 1982 SLM is fed into the Nagra Model E for data recordings.

The Nagra Model E tape recorder is a portable unit, single track, with a frequency response of $\pm$ 2dB from 50 HZ to 15 KHZ using Scotch 212 Iow noise tape. This component with the GR1982, establishes a system that provides recordings of sound data over a frequency range of 50 HZ to 15 KHZ. Calibration of the system is conducted using a GR1562 microphone calibrator at a level of 114 dB at 1000 HZ.

While survey crews were at each location they also made baseline octave band sound pressure level readings. These will serve as a basis for identifying and characterizing any operational sounds which may show spectral prominences. The analog tapes will also be preserved for more detailed analyses if needed.

The survey data are summarized in Table 1. The baseline equivalent sound levels are rather hight. On the west side of the plant site, baseline Ldn values slightly exceed 55 decibel maximum level identified by EPA as requisite to protect public health and welfare (Ref. 1). The baseline Ldn at Chigger Point, across the lake is only one decibel below the EPA level. This community-generated sound seems to originate from insects, motor vehicles, boats, aircraft, birds, and general community activity such as lawn mowing.

Operational Noise Impacts

The two major continuous noise sources considered in this analysis were the switchyard transformers (two banks of three each) and the two natural draft cooling towers Although the transformers do not emit pure tones, they will have a spectral characteristic which might cause the sound to stand out against a random background. Using published values for noise emission from large cooling towers (Ref. 2) and TVA survey data on transformer noise emission (Ref. 3), operational sound levels at the survey points were estimated. Data are presented in Table 2.

In this analysis no consideration is included for attenuation or reflection from nearby surface features such as building, water surfaces, and hills. Obviously, such features can strongly influence propagation of sound waves. For example, the power station buildings will intercept sound traveling from the transformers toward Chigger Point. This will have a lowering effect on operational sounds at Chigger Point. Conversely, operational sound will be reflected by the water surface of Chickamauga Lake as it travels toward Chigger Point. The result could be enhanced sound transmission to Chigger Point.

The effects of the estimated transformer and cooling tower sound levels on the present preoperational (baseline) sound levels are summarized in Table 3.

The data show that transformer and cooling tower sounds will sometimes be audible offsite. Transformer sound will prevail over cooling tower sound at areas on the west side of the plant site, whereas, cooling tower noise will prevail to the east. Due to the high baseline sound levels, the total sound levels during operation will exceed the sound levels identified by EPA as necessary to protect the public with an adequate margin of safety.

Other continuous noise sources not included in this analysis were the building ventilation fans, the intake cooling water pumps, and plant vehicle traffic. TVA experience indicates that these are minor noise sources and should exert little, if any, effect beyond plant boundaries.

Intermittent sound sources will include audible warning systems, plant paging and code-call systems, emergency support systems (e.g., generator and flood pumps), and heavy maintenance equipment. Unfortunately, we do not have a data base on these sources.

Two intermittent and infrequent, but significantly loud, noise sources are the air-blast circuit breakers (ACB) and the steam vents. A one month sample of the ACB records showed that they were exercised approximately 45 times. An ACB underload will generate about 140 decibels of impulse noise at a distance of 50 feet. Sound generated during steam venting is a function of several variables including steam pressure and valve geometry. An estimate of sound emission from the Sequoyah plant vents is not available at this time. We have unofficial data from Ontario Hydro that a sound level of about 84 dBA might be expected at a distance of 2500 feet from a superheater pressure valve venting to atmosphere under 2300 psi steam pressure. Using these sound levels for circuit breakers and steam vents, we can estimate corresponding sound levels at the points of interest around the Sequoyah plant site. These are shown in Table 4. Sound levels of this magnitude will be distinctly audible offsite and will probably not diminish to inaudible levels for distances up to several miles.

Conclusions

Although baseline sound levels are relatively high, sound from the transformer and cooling towers will sometimes be audible offsite. However, since this is a multimode cooling system (open approximately 80 percent of the time helper approximately 16 percent of the time, and closed approximately 4 percent of the time) the amount of time that noise will be emitted from the cooling towers should be minimized. These baseline sound levels will be somewhat augmented by sound from lesser, but yet unquantified, plant sources (plant traffic, communication systems, etc.). Sound from the intermittent and infrequent use of both the air blast circuit breakers and the steam vents will be clearly audible offsite.

References

1. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare With an Adequate Margin of Safety, Report No. 550/9-74-004, USEPA, Arlington, Virginia, March 1974.

2. "Noise Prediction Techniques for Siting Large Natural-Draft and Mechanical-Draft Cooling Towers," G. A. Capano and W. E. Bradley, V. 38, Proceedings of the American Power Conference, 1976, pp. 756-763.

3. "Noise Survey and Impact Report, Volunteer 500 kV Substation Site," C. C. Thornton, TVA Industiral Hygiene Branch Technical Report, IH-76-5, September 24, 1976.

TABLE 1

SUMMER NOISE SURVEY DATA

SITE Sequoyah Nuclear Plant Pr
DATE August 31 (Fri.) and Sept
ENGR. (Sat.) 1979 -- JF & SS

NO	LOCATION		LEVEL Leq	LEVEL Ldn	dBA	31.5	63	125	250	500	1K	2K	4K	8K	16K
					OBSPL – dB – OCTAVE BAND CENTER FREQUENCY										
1.	Northwest of Site. Approx. 2400 ft. from switchyard, 4200 ft. from cooling towers. Sat., Sept. 1, 0158 & 1344 hrs.	Ld	47	56	43	51	49	44	43	40	33	30	33	37	32
		Ln	50		50	49	49	44	44	41	30	46	42	41	35
2.	West of Site. Approx. 2400 ft. from switchyard, 4300 feet from cooling towers. Sat., Sept. 1, 0232 & 1416 hrs.	Ld	48	56	43	47	49	45	39	36	27	28	36	39	37
		Ln	50		49	47	49	42	34	34	25	44	42	45	40
3.	Across river at Chigger Point. Approx. 5700 ft. from switchyard, 3700 ft. from cooling towers, Sat., Sept. 1, 0015 and 1043 hrs.	Ld	45	54	38	40	42	40	37	34	28	27	31	32	25
		Ln	48		47	42	44	42	33	24	16	35	44	43	26
		Ld													
		Ln													
1.	Same location as No. 1 above. Data represents conditions during normal construction. Friday, Aug. 31, 1979, 2057 hrs.	Ld	57		55	52	54	44	39	37	28	28	47	49	52
		Ln													
2.	Same location as No. 2 above. Data represents conditions during normal construction Fri., Aug. 31, 1979, 2024 hrs.	Ld	48		47	57	57	46	43	43	33	41	37	41	26
		Ln													

Table 2

Estimated Operational Sound Levels Near Sequoyah Nuclear Plant

Cooling Tower and Transformer Sound

Location of Assessment Point	Estimated Operational Sound Levels, dBA		
	Cooling Towers *	Transformers **	Combined
No. 1 on map. Residence near plant boundary N.W. of site. 2400 feet from switchyard, 4200 feet from c.t.	50	53	55
No. 2 on map. Residence near plant boundary W. of site. 2400 feet from switchyard, 4300 feet from c.t.	50	53	55
No. 3 on map. Residence on Chigger Point S.E. of plant. 5700 feet from switchyard, 3700 feet from c.t.	51	45	52

*However, since this is a multimode cooling system (open mode approximately 80 percent, helper mode approximately 16 percent, and closed mode approximately 4 percent of the time in the summer months), the amount of time that noise will be emitted from the cooling towers should be minimized.

**The transformers will emit a tone having spectral characteristics rather than pure tones.

Table 3

Operational Sound Impacts From Transformer and Cooling Towers

Summer 1979

		Baseline Sound Level	Operational Sound Level	Total Sound Level	Decibels Increase Over Baseline
No. 1 on map. N.W. of site	Ld	47	55	56	9
2400 feet from switchyard.	Ln	50		56	6
4200 feet from c.t.	Ldn	56		62	6
No. 2 on map. West of	Ld	48	55	56	8
site. 2400 feet from	Ln	50		56	6
switchyard. 4300 feet	Ldn	56		62	6
from c.t.					
No. 3 on map. Chigger	Ld	45	52	53	8
Point 5700 feet from	Ln	48		54	6
swtichyard. 3700 feet	Ldn	54		60	4
to c.t.					

Table 4

Estimated Operational Sound Levels Near Sequoyah Nuclear Plant

Air Blast Circuit Breakers (ACB) and Steam Vent Valves

Location of Assessment Point	Estimated Operational Sound Levels, dBA	
	ACB (Impulse Sound) *	Single Steam Vent
No. 1 on map. N.W. plant. 2400 feet from ACB. 2800 feet from vents	107	83
No. 2 on map. West of plant 2400 feet from ACB. 3100 feet from vents.	107	83
No. 3 on map. Across river at Chigger Point. 5700 feet from ACB, 5400 feet from vents.	99	78

*A random monthly sample of records showed that the ACB's were exercised approximately 45 times.

Figure No. 1
Locations of sound analysis points near Sequoyah Nuclear plant August 31, Sept. 1, 1979