

Region II
26 Federal Plaza, 13th Floor
New York, NY 10278



FEMA

September 12, 2007

Mr. Andrew X. Feeney
First Deputy Director
New York State Emergency Management Office
1220 Washington Avenue, Bldg #22
Albany, NY 12226

Dear Mr. Feeney:

As you are aware, FEMA performed a detailed assessment of the data provided by Entergy Nuclear Operations Northeast in its August 22, 2007 letter (including attachments) pertaining to the newly installed Alert and Notification System (ANS) for the Indian Point Energy Center (IPEC). Our assessment is included as an attachment to this letter. Based on the data and information received from Entergy, its consultants, the counties in the Emergency Planning Zone (EPZ), and our own measurements and observations we have determined that the new ANS installed at and around IPEC is not adequate, in that it does not meet several basic criteria/requirements pertaining to siren systems as set forth in the applicable FEMA guidance. These criteria/requirements were also delineated in the July 20, 2007, FEMA letter to NY SEMO.

More specifically, our analysis of Entergy's submission identified the following major issues that require resolution:

- The inability of the sirens, as installed and tested, to produce an alerting tone that is steady and capable of repetition;
- Sound blocking from co-located sirens, tree limbs and foliage; and,
- Control system issues.

The three major areas identified above must be successfully resolved before the new ANS can be placed into service. Please refer to the Attachment to this letter for further detailed technical analysis.

If we can be of further assistance, please contact us. I can be reached at 212-680-8509.

Sincerely yours,

A handwritten signature in cursive script that reads "Rebecca Thomson". The signature is written in black ink and is positioned above the printed name.

Rebecca S. Thomson
REP Branch Chief and
Regional Assistance Committee Chair

Attachment

cc: Michael Kansler, President, Entergy Nuclear Operations
Samuel Collins, Regional Administrator, NRC, Region I

Attachment
Letter to A. Feeney, SEMO
September 12, 2007

**FEMA Analysis of the Indian Point Energy Center
Alert and Notification System Test Results
September 12, 2007**

The basis for this assessment and finding is delineated in the July 20, 2007 FEMA letter to NYSEMO. To quote it: "NUREG-0654/FEMA-REP-1, Revision 1 [Ref. 7 of the letter], Appendix 3, page 3-8 section g, 'General Considerations' second paragraph states: 'The siren signal shall be a 3 to 5 minute steady signal as described in paragraph IV E of CPG 1-17 [Ref. 9 in the letter] and capable of repetition.' The FEMA 'Outdoor Warning Systems Guide' [Ref. 9 of the letter] Paragraph IV E (page 5) in the section labeled 'Attention or Alert Warning' states: 'This is a 3-to 5-minute steady signal from sirens, horns, or other devices.'

At the time that the guidance [Refs. 7, 8 and 9 of the letter] was developed, there was no general consensus on what constitutes a steady signal. However, it is generally presently accepted that Leq (average sound pressure level) as described in the [Entergy] June 29, 2007 letter for the entire 3 to 5 minute sounding interval is the best representation of a steady output; assuming that the overall signal does not vary by more than ± 2 decibel coverage (dBC). The basis for the ± 2 dBC interpretation comes from the note on Figure 1 (page 10) of FEMA 'Outdoor Warning Systems Guide' [Ref. 9 of the letter] which states: 'Differences less than ± 2 dB(C) in rated output... are not generally significant.'

This point from the July 20 letter was emphasized to Entergy in the July 25, 2007 meeting at IPEC with FEMA, NRC, NYSEMO and Entergy personnel in attendance. In response to specific questions from Entergy concerning use of Leq (equivalent sound level is a weighted average sound output value) to represent the siren output, FEMA stated categorically that Entergy must use a value that is steady and capable of repetition in accordance with the plain language of the guidance. FEMA stated that if Leq represented steady and capable of repetition, that Entergy could use it.

The Entergy letter dated August 22, 2007 included a volume entitled "Individual Siren Ground Level Average (Leq) Sound Pressure Measurements, July 2007." These appear to be the same sound traces that were shown to FEMA in the July 25, 2007 meeting. They were provided in the August 22, 2007 letter upon identification of the need for data that shows the siren alerting tone to be steady and capable of repetition. The sound traces provided show that for every siren using 1 second Leq the sound levels vary in a "saw tooth" manner and rarely, if ever, hold the same reading from one second to the next. Further, the variation from the mean value is almost universally more than 4 dBC both in the positive and negative direction. Thus, the tests performed by Entergy on the installed devices show that none of them are steady as delineated above.

This same siren sound pattern is shown during the siren sounding period on Figures 2 through 14 of Attachment III to the August 22, 2007 Entergy letter. One might contend that the traces shown on those figures are the result of the superimposed background noise onto a steady output. However, decibels are additive logarithmically – so the superimposition of sound levels that are 10 to 30 dBC lower than the fundamental alerting tone would have no effect on the trace. For example, Attachment III pages 4 and 5 notes that the sound contribution of an 8 dBC lower sound pressure level in the 500 Hz 1/3 octave band adds less than 0.5 dBC to the overall siren sound pressure that is in the 630 Hz 1/3 octave band. This report shows that measured ambient noise levels are 30 to 50 dBC less than the siren sound levels in the locations measured. This implies that the ambient noise contribution to the overall sound level measured during siren testing is ~0.05 to ~0.0005 dBC. Further, the traces in these figures do not indicate production of a tone that is steady or capable of repetition.

Please refer to Tables 4 and 5 of Attachment III in the August 22, 2007 letter. Table 4 suggests that for the seven sirens measured from a bucket truck, that the siren output is repeatable. However, Entergy used for the majority of the sirens (and plans to use in the future) ground level measurements to check siren output. As shown in Table 5, for the 13 sirens that were repeatedly measured, there is no instance where two consecutive measurements matched as closely as those shown in Table 4. For sirens 220, 241, 312, 329, 331, 339, 369 and 403; the variation from the lowest to the highest reading over three tests was more than 2 dBC. Further, there did not appear to be general consistent trend among the measurements for any given siren - constant trending up or trending down. This suggests use of a measurement technique to establish siren output that has more variability (and hence less precision) as to actual performance (i.e., increased measurement uncertainty). Use of this data does not support the concept of "capable of repetition." This approach introduces a fundamental flaw in the input used for the siren sound coverage prediction model.

The latest Entergy siren coverage prediction model uses the Leq that was established by use of a ground testing method which has more uncertainty in it than is necessary. Even assuming that everything else is correct in the model, it is only valid if every one of the 155 sirens performs precisely as it is modeled. The variation in measured one-time sound output among the sirens with a spread of roughly 109 to 119 dBC at 100 feet and the variation in measured output among multiple readings of the same sirens using ground level measurements at 100 feet corrected to the horn elevation does not support capable of repetition. This data is in comparison with the vendor claimed rating in the January 5, 2007 design report of at least 125 dBC at 100 feet along with the relevant test reports that were submitted to support the claim.

Nor does this approach address maintenance on or replacement of a non-functioning siren. What is the effect on the affected siren output and hence the system coverage? In order to have a model that consistently and conservatively predicts coverage for the measured output, the sound level used for each siren would need to be representative of the lowest measured output of any functional (meaning a siren that would not show up as "red" on the siren control panel) siren. The Entergy predicted siren coverage and their own measurements show that the siren system does not produce a minimum of 60 dBC in all of the lower population density areas within the EPZ; nor does it provide evidence that

it achieves 70 dBC in all of the areas that have population density above 2,000 persons per square mile.

The Entergy change from insisting that their system would meet 70 dBC and 60 dBC on July 25, 2007 and in later correspondence to only 10 dBC above background in an attempt to justify sound levels less than 70 dBC and 60 dBC at the August 21, 2007 meeting and officially submitted in the August 22, 2007 letter indicates two things to FEMA: (1) Entergy admits that the sirens as installed and tested do not meet the design objectives of the design report dated January 5, 2007; and (2) rather than take suitable corrective action, Entergy is willing to have a system that does not meet its own emphatically stated design objectives, as long as FEMA will allow them to.

Further, the new Entergy design objective of "10 dB above background" is based on a fundamental misrepresentation of FEMA's stated position. The "10 dBC above background" discussion delineated in the FEMA July 20, 2007 letter to NYSEMO was for Entergy to provide suitable evidence that 70 dBC siren system sound level was loud enough for very high population density areas (up to ~ 15,000 people per square mile based on US Census tract data). These areas were not contemplated when the guidance was created since at the time commercial NPP EPZs had predominantly low population densities. The topography around Indian Point is not favorable to siren sound propagation. Thus, the basis for FEMA wanting the three-day ambient noise measurements in areas that have very high population densities and/or high ambient noise from nearby transportation was to allow Entergy to demonstrate that 70 dBC siren system sound levels in these areas was sufficient. However, now that Entergy has produced sufficient evidence that siren system sound levels of 70 dBC is sufficient in the high population areas, Entergy is attempting to change the system sound level design objectives which they held to until the August 20, 2007. The reasons for this last-minute change are readily apparent: (1) the data submitted by Entergy shows that the siren outputs are far below what was claimed in the January 5, 2007 final design report; (2) the sound coverage prediction model submitted with the August 22, 2007 letter shows that at the degraded Leq output condition, the 155-siren configuration cannot meet the 70-dBC and 60-dBC design objectives; and (3) the high population/high ambient noise measurements that were submitted in Attachment III to the August 22, 2007 letter show that the 70-dBC criterion is not being achieved in throughout the high population density areas. This latter point has been validated by independent measurements sponsored by FEMA. The output of these sirens does not meet the "capable of repetition" criterion. FEMA and the NRC both asked Entergy at the August 20, 2007 meeting with NYSEMO representatives present if Entergy would validate the predicted siren coverage against the field measurements that were taken. Entergy explicitly declined this request. Thus, FEMA performed its own validation of the predicted coverage against field measurements already performed. These measurements include those taken by Westchester County, Rockland County, Entergy's consultant Blue Ridge Research and Consulting (BRRC) and independent measurements taken by FEMA. There were 53 field measurements taken during system tests conducted on March 28, August 11 and August 14, 2007 that were used for this validation. BRRC made 36 of these measurements - 25 are included in Attachment III to the August 22, 2007 letter and the remaining eleven are from a BRRC report dated April 7, 2007 that was submitted to FEMA earlier. Five others are near-field siren measurements taken by Westchester

and Rockland County on March 28, 2007. The remaining 12 measurements were part of independent validation measurements sponsored by FEMA during the full system volume tests conducted on August 11 and August 14, 2007.

Overlaying the measurements on the latest sound coverage prediction map submitted with the August 22, 2007 letter shows:

- August 14, 2007 - Ambient sound measurement probe installed on behalf of FEMA shows Leq reading of ~85 dBC within ~2000 feet of siren 301; which is consistent with predicted coverage for this area. However, the BRRC reading at a nearby location for the August 11, 2007 test shows 66.4 dBC (predicted coverage is ~80-85 dBC for this area).
- March 28, 2007 - BRRC Leq reading next to Rockland Lake shows ~69 dBC (siren 228). Entergy predicted coverage is ~10 dBC higher for this location. The main reason for this difference is differing siren sound output on March 28, 2007 based on a near-field measurement taken by Rockland County on that day and what is assumed for siren 228 output in the model which is based on later measurements.
- August 11, 2007 - BRRC Leq reading taken ~1000 feet south of siren 212 shows Leq of 68.3 dBC. Nearby measurement sponsored by FEMA on August 14, 2007 that is ~600 feet farther from the same siren shows ~80 dBC.
- August 14, 2007 - BRRC Leq reading taken ~2000 feet northwest of siren 412 shows Leq of 52.4 dBC. Entergy predicted coverage for this area is ~65 dBC.
- August 11, 2007 - BRRC Leq reading taken ~1500 feet northwest of siren 354 shows Leq of 66.3 dBC. Entergy predicted coverage for this area is ~75 dBC.
- August 14, 2007 - BRRC Leq reading taken at south end of Lake Peekskill (approximately equidistant between sirens 404 and 353) shows Leq of 58.9 dBC. Entergy predicted coverage for this area is ~80 dBC.

Looking at individual siren sound measurements taken during siren system tests on March 28, 2007 and comparing them to the latest values for the siren sound output contained in the August 22, 2007 Entergy letter we get the following results:

Siren Number	Date of Reading / Entity Taking Reading	Measured Siren Output (dBC at 100 feet)	Assumed Siren Output in August 22, 2007 letter (dBC at 100 feet)
332	3/28/2007/ Westchester County	122	112
335	3/28/2007/ Westchester County	122	115
339	3/28/2007/ Westchester County	118	116
227	3/28/2007 / Rockland County	110	113
228	3/28/2007 / Rockland County	110	116
312	3/28/2007 / BRRC	110	113
336	3/28/2007 / BRRC	117	111
407	3/28/2007 / BRRC	113	115

Thus, near-field tests of siren sound output shows that there is variation of siren sound output among tests of the same siren. This variation ranges from 2 to 10 dBC with 4 outputs lower and four outputs higher..

Therefore, these figures clearly show that the new sirens do not meet the steady and capable of repetition criteria. On this basis alone, FEMA finds that the IPEC new siren system does not meet the clear language contained in NUREG-0654/FEMA-REP-1, Revision 1, Appendix 3 as cited in the FEMA July 20, 2007 letter to NYSEMO and as reiterated to Entergy in the July 25, 2007 meeting.

FEMA has assessed other aspects of the new siren system and has additional findings and concerns. These items will need to be addressed in the new design report that Entergy will have to develop and submit to FEMA for FEMA acceptance prior to its installation. The actions to be performed by Entergy to address the relevant FEMA assessments and findings are:

- At any siren site where a new siren is co-located with an existing rotating siren, it is in the direct path of the new siren horn. This means that the new siren array is mounted directly in the sound path (and in many cases within 5 to 10 feet for the siren sites FEMA has assessed) of the rotating siren and therefore blocks sound for 15 to 30 degrees of the total 360 degree horizontal plane rotation path of the existing rotating siren. Thus, the placement of the new sirens decreases the audibility of the existing system. For the reasons that FEMA delineated above, the new electronic sirens that were installed and tested by Entergy do not meet the steady and capable of repetition criteria. Thus, they are unsuitable for use in their present operating condition as demonstrated by Entergy test results. Therefore, the new electronic sirens that were installed and tested by Entergy must be removed from interfering with the sound path of any existing co-located rotating siren in order to restore the existing system to its full functionality.
- Any corrective action proposed by Entergy cannot utilize sirens that do not meet the steady and capable of repetition criteria as delineated above. In short, Entergy must produce suitable credible documented evidence that after the corrective actions are completed (acceptable corrective action includes refurbishment or replacement of the new electronic sirens) and before the new or refurbished sirens are installed in a manner that interferes with existing rotating sirens sound paths, that the system will meet the siren system sound coverage objectives delineated in the January 5, 2007 final design report and will meet the criteria delineated in the FEMA July 20, 2007 letter to NYSEMO.
- FEMA site assessments show that tree growth, and in particular large limb growth within 25 feet of the existing rotating siren horns continues to be a problem. This interferes with the siren sound path. Entergy will need to fully address this problem – first on the existing siren system and also for the new siren system. The methods by which this will be accomplished need to be documented and submitted to FEMA. This includes items such as site photographs, relocation of sirens away from tree limbs, or suitable sound measurements that show that the tree limbs do not interfere with siren propagation, as appropriate.
- The ambient data for very high population density/ potential high ambient noise areas submitted by Entergy (as validated by independent measurements sponsored by FEMA) supports the Entergy January 5, 2007 design report objective that at least 70 dBC is adequate for any area with a population density above 2,000

ppsm, e.g., ambient sound levels in areas of more than 10,000 ppsm will not prevent a 70 dBC alerting signal from being heard outdoors in these areas.

- The control system information will be fully presented including “lessons learned” from the installation and testing of the new system, any corrective actions made, failure modes and effects analysis, a complete delineation of how Entergy plans to address “border” sirens, software QA/configuration control, improved testing methods and frequencies to assure that the entire system is tested on a regular basis, and radio-microwave configuration provides assurance measures for reliability.