MAR 7 1985

Docket: 50-267

Public Service Company of Colorado
ATTN: O. R. Lee, Vice President
Electric Production
P. O. Box 840
Denver, Colorado 80201

We have received the enclosed Federal Emergency Management (FEMA) letter dated February 1, 1985, and associated report on the evaluation of the prompt public alert and notification system. The report includes the results of a survey conducted August 15, 1984, within the 5-mile emergency planning zone (EPZ) around the Fort Saint Vrain Nuclear Generating Station. The survey was performed during the demonstration of the system conducted in accordance with the exercise provisions of 44 CFR 350.9(a) of FEMA's regulations.

The FEMA evaluation stated that, based on data collected during the telephone survey of the public within the 5-mile EPZ, less than half of the households in the EPZ would have been alerted by the tone alert radios which have been designated as the primary alert and notification system. FEMA has concluded that the results of this survey show that the prompt alert and notification system fails to conform to the specific design criteria of NUREG-0654/FEMA-REP-1, Revision 1, and FEMA-43, and therefore, does not provide reasonable assurance that the system is adequate to promptly alert and notify the public in the event of an accident at the Fort Saint Vrain Nuclear Generating Station.

The FEMA letter also states that FEMA intends to pursue corrective actions with the State of Colorado, and plans to verify the effectiveness of corrective actions taken during the next full participation exercise, which is scheduled for June 1985.

Since you as an NRC licensee are responsible for establishing and demonstrating the physical means for alerting and notifying the public, you are requested to submit a written response to this office within 30 days of the date of this letter describing (1) your planned actions to correct the deficiency in the primary alert and notification system, (2) a schedule for completion of the corrective actions, and (3) supplemental means to be provided for promptly alerting and notifying the public until the deficiency is corrected. We will determine an appropriate course of action under our regulations based on your response and the results of the subsequent demonstration of the system.

RIV					
C/EPS	C/EP&RPB	D/DRS&S	SLO	PSA/RPB1	C/RPB1
JBBaird/vs	RHall	RBangart	GSanborn	~~JJaudon~~ RSaulond	EJohnson
3/4/85	3/4/85	03/05/85	3/5/85	3/6/85	3/7/85

IE35 1/1

A045

In accordance with 10 CFR 2.790 of the Commission's regulations, a copy of this letter and the enclosures will be placed in the NRC's Public Document Room.

Should you have any questions regarding this letter, we will be pleased to discuss them with you.

Sincerely,

Original Signed By
E. H. Johnson

E. H. Johnson, Chief
Reactor Project Branch 1

Enclosure:
FEMA letter dated 2/1/85 w/report

cc w/encl.
J. W. Gahm, Manager, Nuclear
Production Division
Fort St. Vrain Nuclear Station
16805 WCR 19½
Platteville, Colorado 80651

L. Singleton, Manager, Quality
Assurance Division
(same address)

bcc to DMB (A045) w/encl.

bcc distrib. by RIV w/encl.:
RPB1
Resident Inspector
Section Chief (RPB1/SPES)
P. Wagner, RPB1
D. Powers, RPB1
EP&RPB
G. Sanborn, RIV
R. P. Denise, DRSP
R. D. Martin, RA
E. Haycraft, LA
J. Miller, ORB3

COLORADO STATE DEPT. HEALTH
D. Matthews, IE, EPB
RIV File
R. Bangart
R. Hall
J. Baird

FORT ST. VRAIN NUCLEAR GENERATING STATION
SITE-SPECIFIC OFFSITE RADIOLOGICAL EMERGENCY PREPAREDNESS
PROMPT ALERT AND NOTIFICATION SYSTEM EVALUATION

Prepared for

Federal Emergency Management Agency
Washington, D.C. 20472
Under Contract No. EMW-83-C-1217

December 14, 1984

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Fort St. Vrain Nuclear Generating Station
Site-Specific Offsite Radiological Emergency Preparedness
Alert And Notification System Evaluation

State Of Colorado

Weld County

I. INTRODUCTION

A. Identification

1. Site Information

The Fort St. Vrain Nuclear Generating Station is located about three and one-half miles northwest of the town of Platteville, Colorado, and about 37 miles north of Denver in Weld County. It is owned and operated by the Public Service Company of Colorado (located in Denver, Colorado) and began commercial operation in 1979.

The area within a few miles of the reactor site is characterized by irrigated farm and pasture land with gently rolling hills.[1] In general, the majority of the land within 30 miles of the site is agricultural.

The population density within the 5-mile emergency planning zone (EPZ)* surrounding the site is relatively low. The population within the 5-mile EPZ is approximately 2,077 persons.[3]

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* The Federal Emergency Management Agency/Nuclear Regulatory Commission (FEMA/NRC) Steering Committee concluded that small water-cooled reactors and the Fort St. Vrain Nuclear Generating Station may use a 5-mile EPZ rather than the standard 10-mile EPZ.[2]

The Fort St. Vrain Nuclear Generating Station is a load-following central station power plant using a high-temperature gas-cooled reactor (HTGR). Utilizing a uranium-thorium fuel cycle, heat is produced by fission in an HTGR. Graphite is used as the moderator, fuel cladding, core structure, and reflector, and helium is the primary coolant. The reactor has an output of 330 MWe.

2. Governments Within The 5-Mile Emergency Planning Zone

The Fort St. Vrain Nuclear Generating Station EPZ consists of a 5-mile-radius circle with the Fort St. Vrain Nuclear Generating Station as the center point. This EPZ lies entirely in Weld County and contains only one town, Platteville. In case of an emergency at the Fort St. Vrain Nuclear Generating Station, the State of Colorado makes the decision to activate the early warning system. Weld County is then responsible for physically activating the tone alert radios.

B. Scope Of Review

1. Emergency Plans For Offsite Response Organizations

All appropriate emergency plans for the Fort St. Vrain Nuclear Generating Station offsite response organizations have been reviewed by FEMA Region VIII and the Regional Assistance Committee and were subsequently recommended for approval under Title 44 of the Code of Federal Regulations, Part 350 (44 CFR 350).

2. Alert And Notification System Design Report

The physical means established for alerting the public within the Fort St. Vrain Nuclear Generating Station EPZ was documented in the following report:

. Federal Emergency Management Agency, Letter from Alton D. Cook, Regional Director, to Richard Krimm, Assistant Associate Director. Subject: Documents to be supportive of the public alerting and notification system evaluation, dated April 2, 1984 (hereinafter referred to as the Design Report).[3]

3. FEMA Evaluation Findings

In a letter to the Honorable Richard D. Lamm, Governor of Colorado, dated January 29, 1982, signed by Lee M. Thomas, Associate Director, State and Local Programs and Support, the Fort St. Vrain Nuclear Generating Station received FEMA approval under 44 CFR 350, conditioned upon the verification of the adequacy of the public alert and notification system.[4]

II. FINDINGS FOR EVALUATION CRITERION E.6

The Design Report describing the alert and notification system for the Fort St. Vrain Nuclear Generating Station was reviewed against evaluation criterion E.6 and Appendix 3 of NUREG-0654/FEMA-REP-1, Revision 1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants" (hereinafter referred to as NUREG-0654/FEMA-REP-1, Rev. 1). This evaluation criterion states:

> Each organization shall establish administrative and physical means, and the time required for notifying and providing prompt instructions to the public within the plume exposure pathway Emergency Planning Zone. (See Appendix 3.) It shall be the licensee's responsibility to demonstrate that such means exist, regardless of who implements this requirement. It shall be the responsibility of the State and local governments to activate such a system.[2]

The bases for review against this evaluation criterion were the corresponding acceptance criteria of FEMA-43, "Standard Guide for the Evaluation of Alert and Notification Systems for Nuclear Power Plants" (hereinafter referred to as FEMA-43).[5] Based upon this review, FEMA concluded that the design and implementation of the alert and notification system at the Fort St. Vrain Nuclear Generating Station and its supporting procedures conformed sufficiently to the acceptance criteria, as stated in FEMA-43, for evaluation criterion E.6 of NUREG-0654/FEMA-REP-1, Rev. 1, to support a finding that the prerequisites for a demonstration of the alert and notification system for the Fort St. Vrain Nuclear Generating Station had been met. This demonstration was conducted on August 15, 1984.

This portion of the evaluation reviews the Fort St. Vrain Nuclear Generating Station's alert and notification system against FEMA-43 acceptance criteria in the following areas: administrative means of alerting, physical means of alerting, and utilization of institutional alerting systems (special alerting methods).

A. Administrative Means Of Alerting (E.6.1, FEMA-43)

The information that is specifically cited in the Public Service Company of Colorado's Design Report addresses those individuals within that organization who are responsible for recommending alert and notification system activation to the local governments. The Design Report also specifies those individuals within the local and state governments who are responsible for alert and notification system activation. After reviewing the aforementioned documentation dealing with emergency procedures for the Fort St. Vrain Nuclear Generating Station, Weld County, and the State of Colorado, the decision logic as shown in Figure 1 was developed.

As Figure 1 indicates, the procedures satisfy the acceptance criteria of FEMA-43. These emergency procedures also specify the means by which the request to activate the alert and notification system at a specified time is conveyed from the Colorado Department of Health to the Weld County Sheriff (who is responsible for alerting the affected population).

Fort St. Vrain Nuclear Generating Station's early warning system employs Weatheralert tone alert radios to notify all residences and businesses within the 5-mile EPZ. These radios are activated by the National Weather Service of the National Oceanic and Atmospheric

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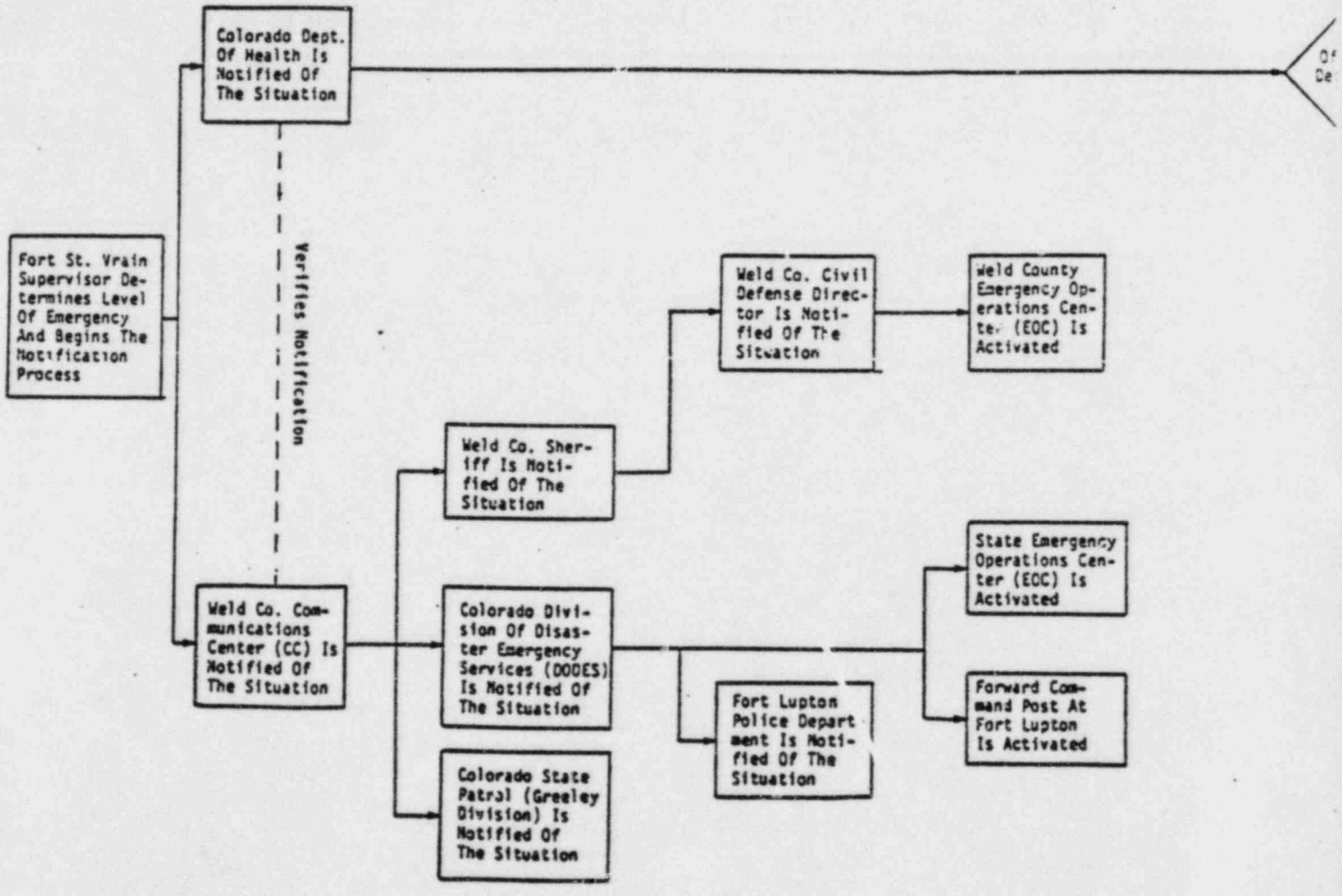
FORT ST. VRAIN NUC

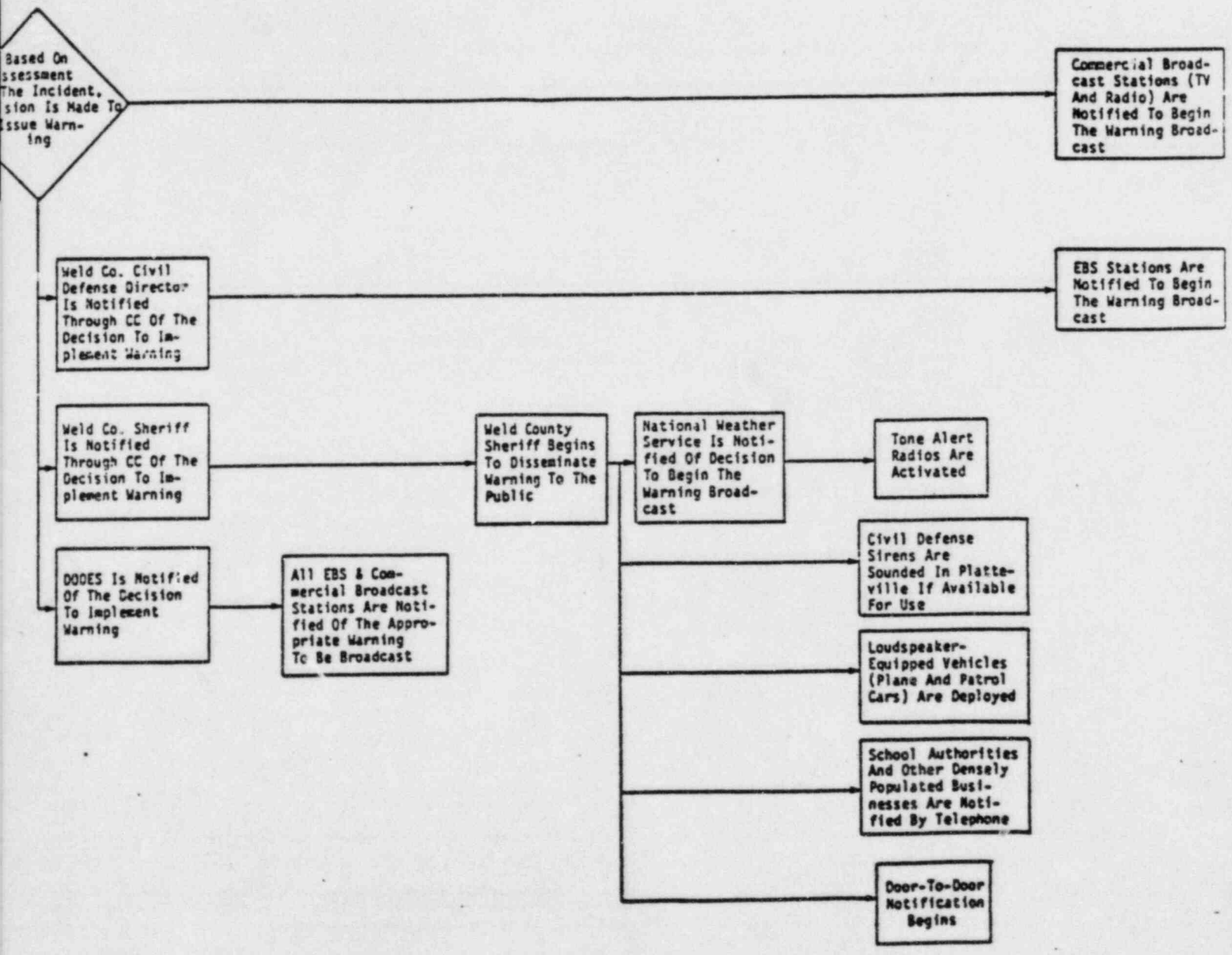
ALERT AND NOTIFICATION SYSTEM AC



URE 1

EAR GENERATING STATION

IVATION DECISION/ACTION SEQUENCE DIAGRAM



Administration (NOAA). Telephone hookups are in place to relay the message to NOAA from the Weld County Sheriff. The emergency broadcast system (EBS) stations receive up-to-date reports on the power station's status from the Weld County Civil Defense Director via a telephone communication system. Additionally, the means are in place for the notification of local school authorities by commercial telephone to inform them of the situation.

B. Physical Means Of Alerting (E.6.2, FEMA-43)

The physical means of the alert and notification system at the Fort St. Vrain Nuclear Generating Station consists entirely of tone alert radios, which have been offered to all residences within the 5-mile EPZ.

1. Tone Alert Radios (E.6.2.3, FEMA-43)

The early warning system for the Fort St. Vrain Nuclear Generating Station is a tone alert system utilizing Weatheralert Model TA-45 weather radios that operate on the National Weather Service communications system. Access to the National Weather Service communications system to broadcast emergency messages concerning the Fort St. Vrain Nuclear Generating Station is described in an agreement between the Division of Disaster Emergency Services and the National Weather Service, both located in the State of Colorado.

FEMA has developed guidelines that should be followed to maintain an effective and continual alert and notification system at the Fort St. Vrain Nuclear Generating Station. These guidelines are as follows:

- The program should offer the tone alert radios to the public in geographical areas where needed and must make a "best-effort" attempt to place the radios. This program should include a record system (register) that contains an accurate list of addresses (names are optional) in geographical areas where tone alert radios are needed. Addresses where radios are offered to residents and refused by the residents should be noted.

- A maintenance program offering operating checks should be available at least annually to all residences in areas where tone alert radios are needed. The maintenance program and the register program mentioned above may be integrated.

- Tests of the tone alerting feature are desired at least monthly. The final determination of testing frequency will rest with appropriate local government officials. The results of these tests do not have to be monitored. The purpose of these tests is to offer the public a means to self-test their receivers.

- Written guidance should accompany the radio. It should address (1) its general use, (2) self-testing frequency and method, (3) suggested placement to facilitate efficient monitoring, (4) the maintenance program, and (5) telephone numbers for repair or replacements. This information should be provided as a reminder to each tone alert radio holder annually. This public information program may also be integrated with the register and maintenance programs mentioned above.

- Determination should be made that the broadcast medium for initiating the tone alert signal has adequate availability (24 hours a day, 7 days a week), signal strength, and signal quality.[5]

The early warning system developed by the Public Service Company of Colorado for the Fort St. Vrain

Nuclear Generating Station, as described in the Design Report, meets FEMA guidelines addressing tone alert radio systems, thus satisfying the criteria of NUREG-0654/FEMA-REP-1, Rev. 1.

In early 1982, the Public Service Company of Colorado identified 1,077 residences and businesses that were located within the 5-mile EPZ. Eleven tone alert radios were not delivered. Of these 11, eight residences could not be contacted (even after repeated attempts), and three residents refused to accept them.[3]

The Public Service Company of Colorado is also developing a system for flagging electric meters, gas meters, or both within the EPZ and will use this system to identify residences that may be vacated, sold, or rented to new persons. This same system will provide information on any new building that is planned for the area.

The Public Service Company of Colorado has turned the system over to the State of Colorado for its use but has agreed to maintain the system. As indicated in the utility's informational brochure and on the radio decal, persons within the EPZ have been given instructions to call the Public Service Company of Colorado for any tone alert problems. Additionally, batteries (the backup power) are mailed to each residence annually or upon request.

The National Weather Service tests the alert system every Wednesday morning between 11:00 a.m. and 12:00 noon (Mountain Time).

The tone alert radios were personally delivered by Public Service Company of Colorado representatives. Operation of the radios was demonstrated and the alert system explained. Each residence was left with a booklet of instructions, as well as a question and answer booklet. In addition to the instruction booklet, a decal was placed on the radio to ensure ready access to emergency instructions.[3]

The National Weather Service operates two stations, providing adequate coverage for all of the residences involved within the 5-mile EPZ.

2. Special Alerting (E.6.2.4, FEMA-43)

The Fort St. Vrain Nuclear Generating Station's early warning system incorporates special alerting, as defined in FEMA-43. The Weld County Sheriff is responsible for requesting the National Weather Service to broadcast warning messages, thereby activating the tone alert radios. He is also responsible for:

- Sounding the Civil Defense warning sirens in the affected area (in coordination with the Weld County Civil Defense Coordinator);

- Deploying loudspeaker-equipped vehicles (a plane and patrol cars) in the affected area;

- Notifying school authorities, other densely populated facilities or institutions, and isolated farm families via telephone and a citizen band radio system (in conjunction with the Weld County Civil Defense Coordinator); and

- Dispatching personnel for door-to-door notification of known handicapped or infirm persons.

Finally, all businesses within the 5-mile EPZ have been given tone alert radios.[3]

III. FINDINGS FOR EVALUATION CRITERION N.1

On August 15, 1984, the physical means (tone/weather alert radios) used to alert the population within the plume exposure pathway EPZ for the Fort St. Vrain Nuclear Generating Station were demonstrated to satisfy the alert and notification aspects of 44 CFR 350.9(a). This demonstration was conducted using the methods specified in Section N.1.(a,b).2 of FEMA-43.[5] The results indicated that this portion of the alert and notification system evaluation was not acceptable and failed to conform to FEMA-43 and NUREG-0654/FEMA-REP-1, Rev. 1.[2]

The August 15, 1984, demonstration of the Fort St. Vrain Nuclear Generating Station early warning system consisted of the transmission of an alerting signal to the tone alert radios within the EPZ and a subsequent telephone survey to estimate the proport on of EPZ households actually alerted and to identify areas where enhancement of the alerting system might be needed. The signal was transmitted at 10:00 a.m. (Mountain Daylight Time).

The telephone survey of EPZ residences was begun at approximately 10:05 a.m. (Mountain Daylight Time) and was completed within one hour and 10 minutes. This survey was conducted by approximately 40 telephone interviewers, each with a separate WATS line and computer terminal.

The universe of households to be surveyed was determined by establishing a 7.5-mile-radius circle around the latitude and longitude of the power station. A sorted master list (addresses and telephone numbers) was obtained of 2,390 households within the 7.5-mile-radius circle. The address of each household was then checked to determine whether the household was within the 5-mile EPZ. This review produced

826 households that appeared to be within the EPZ. These 826 comprise nearly the entire universe of households within the Fort St. Vrain Nuclear Generating Station EPZ. Replicated samples were developed from this list of households. A sufficient number of these subsamples were developed to ensure that the required number of telephone calls could be made, i.e., to establish the proportion of households alerted to within a 5% precision at a 95% confidence level. The method for sizing the sample to achieve this result is described in Appendix A.

To ensure that the Spanish-speaking population was accurately surveyed, some interviewers also conducted the survey in Spanish.

The English and Spanish questionnaires used for the telephone survey are included as Figures 2 and 3.

As part of the telephone survey, 294 households within the Fort St. Vrain Nuclear Generating Station EPZ were contacted and their responses were collected in an automated data base. However, before running the final tabulations, each of these addresses was checked (based on collected crossroads information) on a street map to validate its location. Of these 294 addresses, 33 were outside the EPZ. Therefore, data was tabulated on the 261 respondent households that were located within the EPZ. Respondents at 36 of these households had been away from home at the time of the demonstration of the early warning system and therefore were not included in the alerting analysis. Of the remaining 225 households, 41.3% (93) indicated that they had been alerted during the demonstration. If one uses the estimated number of households within the EPZ (which is 793 according to the

#2106Q
Chilton Research Services
Radnor, Pennsylvania

FIGURE 2

Study #8521
August, 1984

OMB #3067-0103 (FEMA 9/83)
FEMA NUCLEAR POWER PLANT ALERTING AND NOTIFICATION SYSTEM: PUBLIC TELEPHONE SURVEY

FORT ST. VRAIN

Time Began _____ AM _____ PM

Time Ended _____ AM _____ PM

Interview # _____ (1-5)

Zip Code _____ (6-10)

Sample Type _____ (11)

RECORD BEFORE DIALING -Telephone # _____ (12-21)
(Area Code) (Exchange) (Number)

RESPONDENT: Male or Female head of household.

(ASK, DEPENDING ON SEX: Are you the (man of the house/lady of the house)?

INTRODUCTION:

Hello, my name is _____. We're calling households long distance from Chilton Research Services as part of a survey. This survey is sponsored by The Federal Emergency Management Agency (FEMA) of the United States Government.
Your answers are voluntary and will be kept strictly confidential.

1. First of all, is this (REPEAT # DIALED)?

	Yes	1
TERMINATE AND DIAL AGAIN	No	2

2. As you may or may not know, there was a test of the public warning/alert notification system for THE FORT ST. VRAIN NUCLEAR GENERATING STATION. Did you, or any other member of your household, hear a signal from a weather alert radio around 10 A.M. this morning?

22-

SKIP TO Q. 4	Yes	1
SKIP TO Q. 4A	No	2
SKIP TO Q. 4	Heard from another source	3
ASK IF ANY OTHER HOUSEHOLD MEMBER IS MORE KNOWLEDGEABLE	Don't Know	8

Sp. (23-36)

3. THERE IS NO QUESTION #3.

4. (IF "HEARD EMERGENCY SIGNAL" ASK Q. 4 BELOW; OTHERWISE SKIP TO Q. 4A)

Were you at this location when you heard the signal from the weather alert radio?

37-

SKIP TO Q. 5	Yes	1
	No	2

4A. (IF "DID NOT HEAR EMERGENCY SIGNAL")

Were you at this location at around 10:00 A.M. this morning?

38-

ASK Q. 4B	Yes	1
	No	2
	Don't Know	Y

4B. Has this household ever been issued a Weather Alert Radio?

39-

ASK Q. 4C	Yes	1
SKIP TO Q. 5	No	2
	Don't Know	Y

4C. Was the red light on this household's weather alert radio lit today?

40-

Yes	1
No	2
Don't Know	Y

5. Has this household ever received instructions which tell you what to do in the event of a "real" emergency at Fort St. Vrain? These brown brochures in both English and Spanish were sent out by the Public Service Company of Colorado and was entitled, "Information about the Ft. St. Vrain Radiological Emergency Response Plan." Do you remember receiving this information.?

41-

Yes	1
No	2
Don't Know	Y

6. Because we need to determine whether or not this household is within the 5 mile Emergency Planning Zone of Fort St. Vrain, would you please give me the address for this location? (PAUSE FOR ANSWER)

ADDRESS:

_____

_____

and the nearest intersection (or cross street) to this location.

_____

On behalf of Chilton Research Services and the Federal Emergency Management Agency, I would like to thank you for your time and for giving us this valuable information.

#2270Q
Chilton Research Services
Radnor, Pennsylvania

FIGURE 3

Study #8521
August, 1984

OMB #3067-0103 (FEMA 9/93)
FEMA NUCLEAR POWER PLANT ALERTING AND NOTIFICATION SYSTEM: PUBLIC TELEPHONE SURVEY

FORT ST. VRAIN - Spanish Version

Hora comenzado _____AM _____PM

Hora Terminado _____AM _____PM

Entrevistator # _____

Zip Code _____

Sample Type _____

ESCRIBA ANTES DE LLAMAR POR TELEFONO - # _____
(Area Code) (Exchange) (Number)

RESPONDIENTE: El senor o nora cabeza de familia.

(PREGUNTE, DEPENDIENDO DEL SEXO: Es Ud. (la cabeza) de familia?

INTRODUCCION:

Buenas (tardes/dias), mi nombre es _____. Estamos llamando de larga distancia desde Chilton Research Services, como parte de una encuesta, patrocinada por la Agencia Federal del Manejo de Emergencias (FEDERAL EMERGENCY MANAGEMENT AGENCY) del Gobierno de los Estados Unidos.

Sus respuestas son voluntarias y se mantendran en forma confidencial.

1. Primeramente, es este el numero _____(REPITA EL # DE TELEFONO)?

	Si	1
TERMINE Y VUELVA A LLAMAR	No	2

2. Puede que Ud. este enterado que se llevo a cabo una prueba de el alerta del sistema publico de emergencias para la planta generadora nuclear Fort St. Vrain. Escucho Ud., o algun otro miembro de su familia, una senal de alarma en la radio que avisa las condiciones atmosfericas, a las (HORA) de hoy?

SKIP TO Q. 4	Si	1
SKIP TO Q. 4A	No	2
SKIP TO Q. 4	Otro medio	3
ASK IF OTHER HH MEMBER MORE KNOWLEDGEABLE	No Se	Y

FIGURE 3 (CONTINUED)

4. (SI CONTESTAN "ESCUCHE LA SENAL DE EMERGENCIA", PREGUNTE LA P.4 ABAJO, SI NO, PASE A LA P.4A).

Estaba Ud. en ese local cuando escucho la senal de alarma en la radio que avisa las condiciones atmosfericas?

PASE A P. 5	Si	1
	No	2

4A. (SI CONTESTA "NO ESCUCHE LA SENAL DE EMERGENCIA"):
Estaba Ud. hoy en ese local a las (HORA DE LA SENAL DE ALERTA)?

Si	1
No	2
No se	Y

4B. Le lan entregado aud un radio para alertad de eltiempo?

ASK Q. 4C	Si	1
SKIP TO Q. 5	No	2
	No se	Y

4C. Estaba la luz roja encendida en el radio de alerta en el dia de hoy?

Si	1
No	2
No se	Y

5. Han recibido en su hogar instrucciones que dicen lo que hacer en caso de una "verdadera" emergencia en la planta generadora nuclear Fort St. Vrain? Estos folletos de color cafe en ingles y espanol fueron enviados por la Compania de Servicios Publicos de Colorado y se titula "INFORMACION SOBRE EL PLAN PARA EMERGENCIA RADIOLOGICA DE FORT ST.VRAIN". Ud. recuerda haber recibido esta informacion?

Si	1
No	2
No se	Y

6. Debido a que debemos saber si Ud. vive o no dentro de la zona de 5 millas del Plan de Emergencia de Fort St. Vrain, podria darme su direccion?

DIRECCION:

_____

y la calle principal o cruce principal cerca de su hogar es:

_____

En nombre de Chilton Research Services y de la Agencia Federal del Manejo de Emergencias, deseo agradecerle su tiempo y la atencion que mostro al darme esta valiosa informacion.

analyses of sample addresses) in the confidence interval expression in reference 6, it yields an estimated 95% confidence interval for the proportion of the total EPZ population alerted that ranges from 36.0% to 46.9%. In other words, at a 95% confidence level, between 36.0% and 46.9% of the households within the EPZ were alerted by the early warning system.

The sample of 261 households was also used to estimate the proportion of households within the EPZ that stated they received information about what to do in a real emergency at the Fort St. Vrain Nuclear Generating Station. Of these 261 households, 80.5% (210) responded that they had received this information, 13.0% (34) responded that they had not received this information, and 6.5% (17) did not know or refused to state whether they had received this information. Using the approach discussed previously, the following estimates for the entire EPZ population resulted (at the 95% confidence level):

- Between 76.2% and 84.1% of the households would have reported receiving the information;

- Between 10.0% and 16.7% of the households would have responded that they had not received the information; and

- Between 4.5% and 9.4% of the households would not have known or refused to state whether they had received the information.

The survey data were reviewed to identify areas in which the alerting system could be enhanced. The only area identified was public instruction on the operation of tone alert radios.

The survey revealed that 33.8% (76) of those individuals contacted, who were at home at the time of the demonstration, indicated that they were not operating their tone alert radios in a manner that permitted the radio to annunciate upon receipt of an alerting signal. This leads to the conclusion that, at a 95% confidence level, between 28.7% and 39.2% of the households within the EPZ would have reported that they were not operating their tone alert radios so that the radio would annunciate upon receipt of an alerting signal.

The survey was not designed to determine the reasons for the public's apparent failure to make proper use of the tone alert radios. Therefore, the appropriate corrective action is not evident from survey results.

An additional difficulty, related to drawing valid statistical inferences from this survey, arose because the Public Service Company of Colorado conducted a similar concurrent telephone survey. As would be expected concerning an EPZ containing such a small number of households, many households were contacted by both surveys. This may have affected the accuracy of the survey in two ways. First, when our interviewers, unaware of the concurrent survey, contacted a number of households, they were told that the household had already been interviewed. Once we became aware of the other survey, many households had to be recontacted, which added extra time to the interviewing period. The major reason that a relatively large number of interviewers are employed for these surveys is the concern that the information gathered immediately after the alert and notification system demonstration is more accurate than that gathered later. Consequently, anything that delays the survey has the potential to adversely affect its accuracy.

The concurrent Public Service Company of Colorado survey may also have introduced a subtle bias in our survey. It is likely that the Public Service Company of Colorado survey sample was developed from the Fort St. Vrain tone alert radio register. A similar survey has been shown to select a larger fraction of the alerted population than surveys drawn at random from EPZ households.[6] It is reasonable to expect that individuals contacted previously by the Public Service Company of Colorado survey would be more likely to refuse to respond to our survey. Therefore, it is possible that our survey underestimated the actual proportion of the population that was alerted due to this sampling problem. However, since the extent of this possible problem cannot be quantified, it is difficult, if not impossible, to correct for it.

As this discussion indicates, the performance of concurrent surveys by utilities or other organizations during alert and notification system demonstration has the potential to cast doubt upon the overall accuracy of the data gathered and should be avoided in the interest of ensuring a true measure of the alert and notification system performance.

IV. FINDINGS FOR EVALUATION CRITERIA E.5, F.1, N.2, N.3, AND N.5

Those aspects of the alert and notification system addressing evaluation criteria E.5, F.1, N.2, N.3, and N.5 of NUREG-0654/FEMA-REP-1, Rev. 1, have been reviewed by FEMA and found to be adequate to provide reasonable assurance that appropriate protective measures can be taken off site in the event of a radiological emergency. This conclusion is documented in a letter to the Honorable Richard D. Lamm, Governor of Colorado, dated January 29, 1982, signed by Lee M. Thomas, FEMA Associate Director, State and Local Programs and Support.[4] In this letter, the Fort St. Vrain Nuclear Generating Station received FEMA approval under 44 CFR 350, conditioned on an ultimate approval and verification of the public alert and notification system as called for in NUREG-0654/FEMA-REP-1, Rev. 1.

REFERENCE LIST

1. Public Service Company of Colorado. "Public Service Company of Colorado, Fort St. Vrain final safety analysis report." (No date).

2. Nuclear Regulatory Commission and Federal Emergency Management Agency. 1980. "Criteria for preparation and evaluation of radiological emergency response plans and preparedness in support of nuclear power plants." NUREG-0654/FEMA-REP-1. Revision 1. November 1980.

3. Federal Emergency Management Agency. 1984. Letter from Alton D. Cook, Regional Director, to Richard Krimm, Assistant Associate Director. Subject: Documents to be supportive of the public alerting and notification system evaluation, dated April 2, 1984.

4. Federal Emergency Management Agency. 1982. Letters to the Governor of Colorado and to NRC's Executive Director for Operations, from Lee M. Thomas, Associate Director, State and Local Programs and Support, dated January 29, 1982.

5. Federal Emergency Management Agency. 1983. "Standard guide for the evaluation of alert and notification systems for nuclear power plants." FEMA-43. September 1983.

6. International Energy Associates Limited. 1983. "Analysis of tone alert pilot test" IEAL-321. September 1983.

APPENDIX A

Sample Size Determination

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The number of households that need to be surveyed is determined based upon the need to obtain a sample size sufficient to obtain a 95% confidence interval with precision (half-width) of 0.05 for the estimate of the porportion alerted. The exact number of households to be surveyed can be derived from the following statistical considerations. For relatively large sample sizes ($n \geq 30$), taken without replacement from a population (N), the sampling distribution for proportions (e.g., the proportion of the population alerted) is nearly a normal distribution, the mean of which is the proportion (p) of the population alerted and the variance of which is

$$p(1 - p)/n \left(\frac{N - n}{N - 1}\right)$$

If P is the observed sample proportion, then for a particular confidence level with confidence coefficient Z_c,

$$(P - p)^2 \leq Z_c^2 \, p(1 - p)/n \left(\frac{N - n}{N - 1}\right)$$

Thus, for this confidence level, the actual proportion of the population alerted satisfies the following inequalities:

$$\frac{P + \frac{Z_c^2}{2n}\left(\frac{N - n}{N - 1}\right) - Z_c\sqrt{\frac{P(1 - P)}{n}\left(\frac{N - n}{N - 1}\right) + \frac{Z_c^2}{4n^2}\left(\frac{N - n}{N - 1}\right)^2}}{1 + \frac{Z_c^2}{n}\left(\frac{N - n}{N - 1}\right)} \leq p \text{ and}$$

$$P \leq \frac{P + \frac{z_c^2}{2n}\left(\frac{N-n}{N-1}\right) + z_c\sqrt{\frac{P(1-P)}{n}\left(\frac{N-n}{N-1}\right) + \frac{z_c^2}{4n^2}\left(\frac{N-n}{N-1}\right)^2}}{1 + \frac{z_c^2}{n}\left(\frac{N-n}{N-1}\right)}$$

Thus, the precision (W) is simply given by

$$W = \frac{z_c\sqrt{\frac{P(1-P)}{n}\left(\frac{N-n}{N-1}\right) + \frac{z_c^2}{4n^2}\left(\frac{N-n}{N-1}\right)^2}}{1 + \frac{z_c^2}{n}\left(\frac{N-n}{N-1}\right)}$$

This equation can be solved to determine the sample size (n) required to yield a given precision (W) with a given observed sample proportion (P) as follows:

$$n = \frac{\frac{z_c^2}{2W^2}\left[P(1-P) - 2W^2 + \sqrt{W^2\left[1 - 4P(1-P)\right] + P^2(1-P)^2}\right]}{1 + \frac{z_c^2}{2W^2N}\left[P(1-P) - 2W^2\left(1 + \frac{1}{z_c^2}\right) + \sqrt{W^2\left[1 - 4P(1-P)\right] + P^2(1-P)^2}\right]}$$

Although this expression for n can be used directly, it is customary to make several approximations. First, since the term in N in the denominator (the finite population term) is positive definite for all reasonable values of W ($0 < W < 0.5$), omitting this term will result in an approximation to n that is slightly larger than its true value. This is an acceptable practice in sizing the sample since a larger sample gives greater precision.

A second approximation that can be made is to neglect the terms in W^2 within the bracket in the numerator. Analysis demonstrates that this underestimates n when $P < 1/2 - 1/4 \sqrt{2 + 8W^2}$ or $P > 1/2 + 1/4 \sqrt{2 + 8W^2}$ and overestimates n for P between those two values. For the case of interest (a 95% confidence interval with precision of 0.05), this approximation provides an overestimation of n when a sample size greater than 191 is required. Since the sampling plan calls for a minimum sample size of 250, regardless of the value of P, this approximation is acceptable because it also yields an estimate of n larger than the true value. Therefore, for the purposes of the pilot test and subsequent surveys, the following approximate equation can be used to determine whether a sample size larger than 250 is required:

$$n = \frac{Z_c^2}{W^2} P(1 - P)$$

or using 1.96 for Z_c and 0.05 for W,

$$n = 1536.64\ P(1 - P)$$

Data from the pilot test can be used to illustrate the effects of these approximations. In the pilot test, the population of tone alert households from which the sample was to be drawn (N) was approximately 4500 and the observed proportion alerted (P) was 0.675. This yields 311 as the exact result for n. Neglecting the finite population term yields an estimate of 334 for n, and the simplified final approximation estimates n as 338. Thus, the final simplified approximation overestimates the required sample size by 27 in this case.

SOURCE: International Energy Associates Limited. "Analysis of Tone Alert Pilot Test." IEAL-321. September 27, 1983.