August 24, 1983

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
UNION ELECTRIC COMPANY	)	Docket No. STN 50-483 OL
	)	
(Callaway Plant, Unit 1)	)	

APPLICANT'S TESTIMONY OF
NEAL G. SLATEN
IN RESPONSE TO REED CONTENTIONS 6 AND 16
(PROTECTIVE ACTIONS AGAINST RADIOIODINES
AND MESSAGES WITH INSTRUCTIONS FOR
LONG-TERM SHELTERING)

Q.1 Please state your name.

A.1 Neal G. Slaten.

Q.2 Mr. Slaten, by whom are you employed?

A.2 Union Electric Company, St. Louis, Missouri.

Q.3 What is your position and what are your current responsibilities?

A.3 As the Supervising Engineer - Environmental, my normal responsibility is to direct the corporate Environmental and Health Physics Group, which at present consists of two health physicists and two engineers. My duties include: supporting federal, state and local licensing activities; reviewing radwaste, shielding and radiation monitoring system engineering design work; establishing and evaluating off-site radiological environmental monitoring programs; establishing corporate ALARA policy; reviewing conformance to radiological technical specifications; and other duties related to health physics and environmental assessment.

In the event of a Site or General Emergency at the Callaway Plant, I will serve as the Radiological Assessment Coordinator. My duties in that position would include: evaluating and relaying radiological information to the Union Electric Recovery Manager concerning the need to make protective action recommendations to off-site authorities; ensuring the coordination of Union Electric's off-site field monitoring activities with the off-site monitoring conducted by State and

Federal officials; and ensuring that the Recovery Manager is kept appraised of field monitoring results and off-site dose assessment.

Q.4 Please summarize your professional qualifications and your experience with the Callaway Plant.

A.4 I have a Bachelor of Science degree in Aerospace Engineering from St. Louis University, and a Master of Science degree in Nuclear Engineering from the University of Missouri at Columbia. I was first employed by Union Electric Company in 1972 as an engineer with responsibilities in the areas of licensing and nuclear steam supply system design review for the Callaway Plant. In 1978 I was appointed as a Nuclear Environmental Engineer, and in 1980 I attained my present position of Supervising Engineer, Environmental. A complete statement of my professional qualifications is appended as Attachment 1 to this testimony.

Q.5 Mr. Slaten, please describe the purpose of your testimony.

A.5 I understand Reed Contentions 6 and 16 in part to challenge the effectiveness of sheltering and of ad hoc respiratory protection as protective actions in the event of a release of radioactive material, including radioiodine, from the Callaway Plant. The purpose of my testimony is to establish the effectiveness of those protective actions. In addition, I will show that appropriate instructions will be provided to the affected public on the implementation of these protective actions.

Q.6 If an accident were to occur, what health risks would be posed?

A.6 As a result of a reactor accident which results in a significant atmospheric release of radioactive material, the public may receive radiation doses from three exposure modes. These include: (1) exposure to external radiation as the plume passes; (2) exposure to external radiation from radionuclides deposited on the ground and other surfaces during and after cloud passage; and, (3) internal exposure due to radionuclides inhaled from the passing cloud. Thus, protective actions to reduce exposure should be considered for the direct external exposure and inhalation exposure pathways during cloud passage, and for external exposure pathways after cloud passage. Of course, with respect to radioiodines, the inhalation pathway would be most important.

Q.7 Please describe the role sheltering might play as a protective action.

A.7 Sheltering may be defined as a deliberate action by the public to take advantage of the inherent radiation shielding available in normally inhabited structures by remaining indoors, away from doors and windows, during and after the passage of the cloud of released radioactive material. Inherent structural shielding can afford protection against exposure to external sources. Furthermore, the exclusion of a significant amount of airborne radioactive material from the interior of a structure, either by natural effects or certain ventilation strategies, can reduce the amount of inhaled radionuclides as well. Actions taken to effectively shelter would not vary according to the duration of time one expected to stay indoors.

Q.8 Under what circumstances would the public in the plume exposure pathway be directed to take shelter?

A.8 Pursuant to the State of Missouri Nuclear Accident Plan -- Callaway, the Bureau of Radiological Health ("BRH") has the responsibility to recommend to the other State and local response organizations the initiation of protective actions. Sheltering is simply one of a number of protective actions available to BRH to recommend if conditions warrant such action.

The decision to initiate a protective action may be a complex process with the necessity to weigh the benefits of taking such action against the risks. Because of this, Protective Action Guides have been developed to reduce to manageable levels the decisions that must be made to protect the public in the event of a nuclear accident. One of the available protective action options is to advise the public to take shelter. (See State PAG's contained in State Plan, Annex B.) Such a recommendation would be particularly appropriate where there is a low dosage airborne release, or when there is a higher release but evacuation is not immediately possible. The option of sheltering is not intended to be equivalent to evacuation; rather, it provides another means of achieving the overall objective of emergency response plans: providing dose savings for a spectrum of accidents that could produce off-site doses in excess of PAG's.

Q.9 How effective is sheltering as a protection against radioiodines?

A.9 The shielding effectiveness of a structure is expressed in terms of a shielding factor, which is the ratio of the dose received inside the structure to the dose that would be received outside the structure. Estimates have been made of shielding for several distinct building types using currently available shielding technology. These include shielding factors for external exposure from cloud passage and external exposure from radionuclides deposited on the ground and other surfaces. The estimates indicate both that a wide range of potential shielding factors is afforded by normally inhabited structures and that basements of both homes and larger buildings offer very effective shielding against radiation. In general, shielding factors associated with direct radiation from a passing cloud range from a low of 0.1 for a basement to a high of 0.9 for a wood-frame house with no basement. For example, a projected dose of 900 mrem would most likely result in a sheltering recommendation. Sheltering oneself in a wood frame house would reduce this dose to 810 mrem. By moving to the basement, one could reduce this dose to as low as 90 mrem. Shielding factors for surface deposited radionuclides range from a low of 0.001 for a basement of a large building to 0.5 for a wood-frame house with no basement. The average shielding factors for the midwest region are 0.5 for direct radiation from a passing cloud and 0.09 for direct radiation from surface deposited radionuclides. (See Aldrich, Ericson & Johnson, Public Protection Strategies for Potential Nuclear Reactor Accidents: Sheltering Concepts with Existing Public and Private Structures, SAND-77-1725, Feb. 1978).

The reduction of inhaled radionuclides also lessens the risk of health effects from a passing radioactive plume. Studies indicate that sheltered individuals receive a reduction of approximately 35% in the dose from inhaled radionuclides. Larger reductions would be possible if the ventilation rate was further reduced by tighter building construction, emergency sealing of openings in the structure or by the use of basements during plume passage. This reduction in inhalation dose would not change regardless of the time spent in the area after plume passage since the inhalation pathway would be relatively insignificant following passage of the plume. (See Aldrich & Ericson, Public Protection Strategies in the Event of a Nuclear Reactor Accident: Multicompartment Ventilation Model for Shelters, SAND 77-1555, Jan. 1978).

The effectiveness of sheltering as a protective action over time depends on many factors such as meteorological parameters, plume deposition, type of structure, magnitude of release and duration of cloud passage. The release (or cloud passage) durations associated with release categories investigated in the Reactor Safety Study ranged between 0.5 to 10 hours with most of the release durations falling in the 0.5 to 3.0 hour range. Any subsequent protective action taken in addition to sheltering, such as evacuation, would not affect the dose received through inhalation (i.e., after plume passage there is no longer an inhalation pathway of significance). Past this time, deposited radionuclides continue to expose the sheltered individual, although exposure is reduced through structural shielding. The administration of KI would not protect individuals from this type of exposure. Consequently, depending upon the magnitude of the release, the half-lives of released radionuclides, and the plume deposition, the possibility cannot be eliminated that evacuation protective action guides could eventually be exceeded at some time after plume passage due to direct exposure from deposited radionuclides. In such a case, evacuation would be accomplished prior to release or, if not possible, sheltering would be recommended until passage of the plume followed by evacuation as soon as possible.

In postulating the need for long-term sheltering and KI as an attendant protective action, Mr. Reed appears to have ignored these facts. In short, KI is only useful protection against the inhalation pathway during plume passage, which should be from 0.5 to 3.0 hours. Subsequently, KI will be of no assistance in protecting individuals from deposited radionuclides.

Q.10 Would you define the role ad hoc respiratory protection might play in increasing respiratory protection in a shelter mode?

A.10 Ad hoc respiratory protection from readily available common household materials such as fabrics, towels, sheets, etc., has been shown to be effective for both particles (dusts or aerosols), vapors, and radioactive gases including radioiodine. Such inhalation protection would be valid for the public remaining indoors (sheltering) or for brief movement outdoors during passage of a radioactive cloud or plume. In addition, such ad hoc respiratory protection would increase the inherent protection provided by sheltering within a structure. This protection is afforded either by natural sealing of the building or by certain ventilation strategies which inhibit air and dust movement from the exterior of the building into areas occupied by the public during passage of a released radioactive cloud or plume.

Q.11 What degree of effectiveness do such measures afford?

A.11 The effectiveness of ad hoc respiratory protection is expressed in terms of filter efficiency or penetration of dusts, aerosols or gases through the ad hoc respirator materials. Research into the effectiveness of emergency respiratory protection using common household and personal items has been undertaken for over 20 years, with much of the early work done at the request of the Atomic Energy Commission. Initial research studied some eighteen variations of eight household and personal items, with military personnel using these materials as respiratory protection expedients in a calibrated atmosphere of particles in an aerosol. These early tests gave results (see attached Table "A") indicating that five variations involving a man's cotton handkerchief, commercially available toilet paper, and a bath towel, had a filtration efficiency greater than 85 percent (meaning that 85% of the particles were not inhaled because of the ad hoc respiratory protection). Resistance to breathing offered by each medium also was evaluated with a few of the variations rejected because of excessive breathing resistance. In general, the medium needs to be damp but not too wet (see footnote A in Table "A"); however, excessive wetting of the initial test material could increase resistance to breathing, indicating that use of very wet items is not generally practical. In all instances, a good fit on the face, to assure edges were sealed, is essential to obtain maximum effectiveness of the expedient material; however, this is also a limitation applicable to commercially-available respirators. (See the 1963 American Industrial Hygiene Association Respiratory Protective Devices Manual, "Household Items for Emergency Use in Civilian Defense," pages 123-126; and the A.M.A. Archives of Industrial Health, "Emergency Respiratory Protection Against Radiological and Biological Aerosols," Vol. 20, page 91-95, Aug. 1959).

Further research conducted by the Department of Environmental Health Sciences, Harvard School of Public Health has been published as NUREG/CR-2272, Expedient Methods of Respiratory Protection, November 1981, for the U.S. Nuclear Regulatory Commission; and as "Emergency Respiratory Protection with Common Materials," Am. Ind. Hyg. Assoc. Journal 44(1): 1-6 (1983) by D. W. Cooper, W. C. Hinds, and J. M. Price. In addition, remarks "On the Efficacy of Ad Hoc Respiratory Protection During a Radiological Emergency" were presented by James A. Martin, Jr., an NRC Staff member, as paper P/50 at the 1981 Annual Meeting of the Health Physics Society, based in part on the data by Cooper, et al. (Harvard University). The Harvard data were also included in a paper presented by D. C. Aldrich at an Electric Power Research Institute symposium on radiological emergency planning held January 12 and 13, 1982 and published in NSAC-50, "Are Current Emergency Planning

Requirements Justified," NSAC-EPRI, May 1982. As discussed below, these papers reflect the current state of the art with respect to ad hoc respiratory protection.

The reports by Cooper and associates were the result of extensive studies of the ability of readily available fabrics to filter aerosols, gases and vapors expected to be emitted in the event of a major nuclear reactor accident using calibrated particles. The results, while somewhat different, were consistent as to the value of ad hoc material from those obtained earlier. Decreases in particle concentrations by a factor of ten or more were possible from the fabrics tested, when operated at a pressure drop deemed acceptable for breathing comfort. Protection from Krypton-85 by dry fabrics and from radioiodine using wetted fabrics (with water or a baking soda solution) was appreciable. Follow-up studies by Harvard University are continuing.

These test results show that readily available materials can provide substantial reductions in concentrations of particles and certain water-soluble gases and vapors at pressure drops acceptable for respiratory protection during nuclear power plant accident conditions. Leakage around the seal to the face could reduce the protection provided, as noted in the earlier studies, but this problem is associated with the use of commercially-available respirators as well. Table "B" summarizes the data from these studies. Of importance was the finding that wetted sheets and towels would provide respiratory protection from iodine vapor, reducing iodine concentrations by a factor of ten.

While neither of the studies specifically address the duration of the protection, the earlier report stated that the dry bath towel and man's handkerchief variations did not appear to have any serious limitations as to the duration of use. The Harvard research did not indicate any significant breathing difficulties could be anticipated by the use of towels or handkerchiefs even when wetted. Comparing these materials with a 3M dust respirator, a half-mask fabric respirator, the authors of the reports felt the masks could be worn for hours without substantial discomfort and the fabrics could be tied or taped to the face for shorter periods during the passage of a puff or plume, during travel to shelter, or during relocation, indicating suitable duration of use during nuclear accident scenario conditions.

In a qualitative sense, then, these research studies indicate that it would be advisable to cover the nose and mouth during possible exposure to airborne radioactive material following a nuclear reactor accident if the plume is likely to cause airborne concentrations that would result in radiation doses to the public in excess of protective action guides. Further research is underway to quantify this perhaps self-evident statement. As stated by Martin in the abstract for paper P/50, "[t]hese studies demonstrate that application by the public of ad hoc shelter and respiratory protection could provide inhalation pathway protection factors (PFs) of ten or more, with shelter providing a PF of two to ten and ad hoc respiratory protection providing an additional PF of three to twenty, or so."

Martin points out that "[t]hese potential PFs are very competitive with that of potassium iodide (KI) for the thyroid, but the former would protect other organs as well." (emphasis added). Martin further adds that ". . . ad hoc shelter and respiratory protection could be used to reduce doses in cases where expeditious evacuation would not be feasible . . . ."

In conclusion, there is no mystery to the concept that ad hoc respiratory protection can be effective in providing inhalation filtering of potentially hazardous airborne material. It is common knowledge that covering the nose and mouth of family members with damp cloths is an effective ad hoc method of minimizing smoke inhalation during fires. Common sense as well as scientific research dictates that similar action be taken upon instruction by appropriate authorities following the release of significant quantities of airborne radioactive material during a radiological accident at the Callaway Plant.

Q.12 Will the public be adequately instructed in the use of such measures?

A.12 Following an accident at the Callaway Plant, the public would be instructed in appropriate protective action by appropriate authorities, including when to initiate and when to stop the use of ad hoc respiratory protection (if needed at all). Proper instruction to families as to the use of ad hoc respiratory protection will be done through pre-established public messages over the Emergency Broadcast System ("EBS"). Parents would be able to monitor the proper use and comfort of ad hoc respiratory protection by the younger members of the family according to these instructions, with no likelihood that young children could suffocate from the use of ad hoc respiratory protection.

Instructions for taking shelter will also be provided through pre-established EBS public messages and public information previously sent to residents. Residents in designated areas recommended for sheltering will be advised, among other things, to close all windows and doors, turn off fans and air conditioners, and close all other air intakes. Those who have been outside will be advised to shower and to wash clothing worn outside. Instructions will be given to cover all open food containers and, at a minimum, to wash hands and faces before handling or eating food. These instructions would not vary according to the duration of shelter.

Q.13 Mr. Slaten, what are your conclusions, then, with respect to the influence of the effectiveness of sheltering and ad hoc respiratory protection on the State's policy decision not to pre-distribute potassium iodide to the general public?

A.13 Sheltering and ad hoc respiratory protection are effective protective actions in that they will reduce the radiation exposure of the general public resulting from a reactor accident with atmospheric release of radioactive material. The protection factors achievable with these protective actions are comparable to the use of potassium iodide. These protective actions are not, however, a substitute for evacuation.

Mr. Reed appears to postulate a scenario in which the radioactive plume arrives off-site quickly, requiring resort to sheltering where evacuation might otherwise have been undertaken, and then remains for an extended period of time -- exposing the public who cannot evacuate because the roads are blocked with snow. This ignores the fact that the meteorological conditions which caused the plume to move off-site quickly would also result in rapid dispersion and/or passage of the plume resulting in a reduced inhalation dose. After plume passage, evacuation could be accomplished, if desired, after clearing of roads or, if necessary, with the help of National Guard helicopters.

It is always possible to postulate a scenario in which long-term sheltering might be required because of the infeasibility of evacuation. Given our knowledge of how accidents evolve, however, as well as the advance warning which in most cases will be available, such a scenario is extremely remote. Emergency response planning should address a spectrum of accidents, but should not focus upon an isolated, single accident sequence of extremely low likelihood. In any case, the Missouri National Guard can provide air evacuation by helicopters from Jefferson City if it should become necessary to evacuate isolated residents who cannot evacuate on their own. See Attachment 2 to this Testimony.

TABLE 11.5

RESPIRATORY PROTECTION PROVIDED BY COMMON HOUSEHOLD AND PERSONAL ITEMS AGAINST AEROSOLS OF 1 TO 5μ PARTICLE SIZE

Item	Number of Thicknesses	Resistance, mm of H_2O	Number of Observations	Geometric Mean Efficiency, %	95% Confidence Limits for Mean, % Lower	95% Confidence Limits for Mean, % Upper
Handkerchief, man's cotton	16	36	32	94.2	92.6	95.5
Toilet paper	3	13	32	91.4	89.8	92.8
Handkerchief, man's cotton	8	18	32	88.9	85.5	91.6
Handkerchief, man's cotton	Crumpled	--	32	88.1	85.1	90.5
Bath towel, turkish	2	11	32	85.1	83.3	86.8
Bath towel, turkish	1	5	30	73.9	70.7	76.8
Bed sheet, muslin	1	22	32	72.0	68.8	74.9
Bath towel, turkish	1 (wet)	3	31	70.2	68.0	72.3
Shirt, cotton	1 (wet)	>150[a]	15	65.9	57.9	72.3
Shirt, cotton	2	7	30	65.5	60.8	69.6
Handkerchief, woman's cotton	4 (wet)	84[a]	32	63.0	57.3	67.9
Handkerchief, man's cotton	1 (wet)	98[a]	30	62.6	57.0	67.5
Dress material, cotton	1 (wet)	180[a]	31	56.3	49.6	62.0
Handkerchief, woman's cotton	4	2	32	55.5	52.2	58.7
Slip, rayon	1	6	32	50.0	46.2	53.6
Dress material, cotton	1	5	31	47.6	41.4	53.2
Shirt, cotton	1	3	32	34.6	29.0	39.9
Handkerchief man's cotton	1	2	32	27.5	22.0	32.5

a. Resistance obtained when checked immediately after hand wringing. This resistance began to decrease after about one minute when the material started to dry.

TABLE B ESTIMATED PENETRATION THROUGH EXPEDIENT RESPIRATORY PROTECTION MATERIALS AT 50 Pa (0.2 IN H_2O) PRESSURE DROP AND 1.5 CM/S FACE VELOCITY

DRY

Material	No. layers	Aerosol particle diameter (μm) 0.4	1	5	I_2[b]	CH_3I[b]
3M respirator[a] # 8710	2	.03	.004	<.01		
Sheet	20	.66	.64	.020	1.0	0.6[c]
Shirt	15	.54	.59	.070		
Lower-quality towel	20	.53	.41	.015		
Higher-quality towel	6	.24	.13	<.01		0.6[c]
Handkerchief	14	.61	.54	.032		

WET

Material	No. layers	Aerosol particle diameter (μm) 0.4	1	5	I_2[b]	CH_3I[b]
Sheet	6	.91	.88	.22	.45 .15[d]	.8[c] 1.0[d]
Shirt	6	1.0	.51	<.02		
Higher-quality towel	4	.20	<.01	<.01	.21 .10[d]	1.0
Handkerchief	2	.98	.95	.37		

a. Available commercially in single-layer thickness.
b. Taken from tests at 1.0 cm/s, assuming penetration is the product of single-layer penetrations.
c. Not shown to be statistically different from 1.00.
d. Wetted with 5% by weight baking soda solution.

Taken from NUREG/CR-2272 (Nov. 1981) at 84.

PROFESSIONAL QUALIFICATIONS & EXPERIENCE

Neal G. Slaten - Supervising Engineer, Nuclear Envii nmental

Education - Bachelor of Science, Aerospace Engineering, St. Louis University

Master of Science, Nuclear Engineering, University of Missouri - Columbia

Related Training - Westinghouse International School for Environmental Management Colorado State University, 1973

Westinghouse "Head Start" Program, 1973

Westinghouse "Head Start" Program Simulator, 1973

AIF Seminar, "Preparing Environmental Technical Specifications for Nuclear Power Plants", 1974

Course in "Environmental Analysis and Environmental Monitoring for Nuclear Power Generation" University of California - Berkeley, 1974

Course in "Environmental Radiation Surveillance for Nuclear Power" Harvard School of Public Health, 1976

AIF Seminar, "Current Issues on Environmental Regulation of Nuclear Power Facilities", 1977

Bechtel Auditor Training, 1978

NRC Seminar, Model Radiological Effluent Technical Specifications for Nuclear Power Plants, 1979

ASME/EPRI Radwaste Workshop, 1979

AIF Seminar, Standard Emergency Response Plan, 1979

NRC Seminar, Emergency Planning, 1980

INPO Radiological Protection Seminar, 1982

Hazardous Waste Management Summer Institute
University of Missouri, Columbia, 1982

Seminar on Medical Management of Radiation Injuries, 1982

Applied Health Physics Course
Oak Ridge Associated Universities, 1982

EEI Health Physics Committee Representative, 1977 to present

Professional Societies - Health Physics Society

Experience - 1972-1978, Engineer. Responsibilities included Licensing and NSSS design review.

1978-1980, Nuclear Environmentl Engineer. Responsibilities included Radwaste Systems design review, Environmental Assessment and monitoring programs, Environmental Report & general Licensing activities.

1980-Present, Supervising Engineer, Environmental. Responsibilities include: directing the corporate Environmental and Health Physics Group; Licensing support; reviewing radwaste, shielding and radiation monitoring system engineering design work; evaluating off-site radiological and non-radiological environmental monitoring programs; establishing corporate ALARA policy; reviewing conformance to provisions contained within technical specifications and applicable license provisions pertaining to radiological matters; providing technical expertise to QA audit teams; reviewing design modifications to assure compliance with ALARA philosophy; acting as Radiological Assessment Coordinator during a site or General Emergency at Callaway Plant.

Christopher S. Bond
Governor

ATTACHMENT 2

Charles M. Kiefner
Major General, MOARNG
The Adjutant General

DEPARTMENT OF PUBLIC SAFETY

HEADQUARTERS MISSOURI NATIONAL GUARD

Office of the Adjutant General
1717 Industrial Drive
Jefferson City, Missouri 65101
Phone 314 — 751-2321

JAN 1983
RECEIVED

January 6, 1983

Union Electric Company
Attention: Mr. M. A. Stiller
Post Office Box 620
Fulton, Missouri 65251

Dear Sir:

This correspondence is in regard to your letter, dated November 10, 1982, and in accordance with the Missouri Nuclear Accident Plan, dated June 1982.

Assumptions in the use of the Missouri National Guard are:

a. Missouri National Guard personnel will not be assigned missions in areas where the possibility of dangerous levels of radiation exists.

b. The Missouri National Guard will respond to a nuclear power plant emergency as declared by the Governor with available personnel and resources.

c. That a civilian authority is designated as a point of contact prior to the National Guard being assigned a mission.

d. That missions be assigned by civil authorities, but the execution to include the number of personnel and equipment to be used, will be determined by the Missouri National Guard.

The Missouri National Guard will provide support as follows:

a. One hundred twenty Guardpersons will be available for traffic control and assist in local radiation survey. Personnel will be furnished from the following units:

Headquarters, Missouri Army National Guard (Jefferson City)

1175th Military Police Company (Boonville and Moberly)

Headquarters and Headquarters Battery, 1st Battalion, 128th Field Artillery (Columbia)

1035th Maintenance Company (Jefferson City)

Service Battery, 1st Battalion, 128th Field Artillery (Mexico)

Headquarters and Headquarters Detachment, 735th Maintenance Battalion (Jefferson City)

b. The expected response time for the designated units is six hours after the initial notification.

c. Guardpersons that would be used for surveying personnel and equipment for radioactive contamination to include themselves will receive initial training and annual refresher training.

d. Air Evacuation would be performed by helicopters from Jefferson City. Normally, during working hours reaction time to Readsville and Mineola would be two hours. During non-duty hours, response could be up to four hours.

The Missouri National Guard has been called to State Emergency Duty 22 times in the past five years. The response time was between four and six hours, primarily dependent on unit members traveling to Armories and preparing vehicles for Operations under adverse weather conditions.

Sincerely,

Charles M. Kiefner

CHARLES M. KIEFNER
Major General, MOARNG
The Adjutant General