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Mr. Thomas T. Martin
Administrator, Region I
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Subject: Three Mile Island Nuclear Station, Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
NRC Inspection No. 50-289/95-05
Request For Information About TMI PAR Logic Diagram

Dear Sir:

This letter transmits the information requested by Mr. J. H. Joyner in the NRC letter dated June 2, 1995, about the bases for the Three Mile Island Protective Action Recommendation (PAR) Logic Diagram. As requested, Attachment I includes the assumptions and analyses utilized in the PAR logic diagram development, and the procedures by which operators estimate the release duration and the uncertainty associated with that estimate. Attachment I also provides sufficient detail to demonstrate that this PAR logic will provide protective actions equivalent to the guidance in EPA-400, "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents."

Should you have any questions pertaining to Attachment I, please contact G. Simonetti at (717) 948-2081 for more information.

Sincerely,

P.S. Wall
for T. G. Broughton
Vice President and Director, TMI

AWM/mkk

cc: M. G. Evans - TMI Senior Resident Inspector
R. W. Hernan - Senior Project Manager
J. H. Joyner - Chief Facilities Radiological Safety and Safeguards Branch

ATTACHMENT I

PROTECTIVE ACTION RECOMMENDATION (PAR) LOGIC DIAGRAM BASIS

Executive Summary

The Environmental Protection Agency's "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents" (EPA-400) requires evacuation at 1 Rem Total Effective Dose Equivalent (TEDE). However, it goes on to say, "Sheltering may be preferable to evacuation as a protective action in some situations." "Physical constraints to evacuation--e.g. inadequate roads" is an example it lists as one where sheltering would be preferable. The area around the Three Mile Island Nuclear Generating Station (TMI) is highly populated with a road system that cannot always support an expeditious evacuation of the full 10 mile Plume Exposure Pathway Emergency Planning Zone (EPZ). Hence, for TMI there are times when sheltering is a preferable protective action.

If TMI's situation is such that there is an actual or potential release that could result in an unprotected population exceeding 1 Rem TEDE or 5 Rem Committed Dose Equivalent (CDE) to the Child Thyroid, GPU Nuclear's preference is to evacuate the 5 mile radius and 10 miles downwind. We will make such a recommendation unless sheltering is determined to be the preferable action. Exhibit 1 of TMI's "Emergency Operations Facility Procedure" (EPIP-TMI-.27) provide the Emergency Support Directors with clear, definitive guidance on how to determine whether evacuation or sheltering is the preferred protective action. The procedure will recommend evacuating the largest possible area that can complete the evacuation prior to one hour before the release is terminated. Such guidance provides a recommendation which will result in the least dose to the public and provide the maximum protection for those most at risk (closest to the site).

The following tables are provided to illustrate a comparison between TMI's Protective Action Recommendation (PAR) Logic Diagram and the Nuclear Regulatory Commission's diagram contained in Response Technical Manual (RTM)-92 Volume 1 Rev 2 and RTM-93 Volume 1 Rev 3. It also compares the dose received to the public using our recommendation against Pennsylvania's policy that only evacuations of the full EPZ will be considered. The general assumptions used to generate these tables are the same as those used to initially generate the PAR Logic Diagram. They are covered in detail under the "Assumptions" section of this response. The doses given represent the dose to the maximum exposed individual carrying out the corresponding protective action recommendation.

Case I: Long Estimated Release Termination Time (24 hours)

Release Starts 3 hours after General Emergency declaration.   Release is terminated 24 hours after declaration

	Recommendation	Site Boundary Dose	2 Mile Dose	5 Mile Dose
GPUN	Evacuate 5 mile radius and 10 miles downwind.	26.5 Rem TEDE	.530 Rem TEDE	.265 Rem TEDE
NRC	Evacuate 2 mile radius and 10 miles downwind. Shelter remaining area.	26.5 Rem TEDE	.530 Rem TEDE	.265 Rem TEDE
State	Evacuate 10 mile radius.	26.5 Rem TEDE	.530 Rem TEDE	.265 Rem TEDE

Case II: Medium Estimated Release Termination Time (5 hours)

Release Starts 3 hours after General Emergency declaration.   Release is terminated 5 hours after declaration

	Recommendation	Site Boundary Dose	2 Mile Dose	5 Mile Dose
GPUN	Evacuate 2 mile radius and shelter 10 miles downwind.	0 Rem TEDE	.100 Rem TEDE	.050 Rem TEDE
NRC	Evacuate 2 mile radius and 5 miles downwind. Shelter remaining area.	10 Rem TEDE	.200 Rem TEDE	.050 Rem TEDE
State	Evacuate 10 mile radius	10 Rem TEDE	.200 Rem TEDE	.100 Rem TEDE

Case III: Short Estimated Release Termination Time (2 hours)

Release Starts 1 hours after General Emergency declaration.   Release is terminated 2 hours after declaration

	Recommendation	Site Boundary Dose	2 Mile Dose	5 Mile Dose
GPUN	Shelter 2 mile radius and shelter 10 miles downwind.	2.5 Rem TEDE	.050 Rem TEDE	.025 Rem TEDE
NRC	Evacuate 2 mile radius and 5 miles downwind. Shelter remaining area.	5.0 Rem TEDE	.100 Rem TEDE	.025 Rem TEDE
State	Evacuate 10 mile radius.	5.0 Rem TEDE	.100 Rem TEDE	.050 Rem TEDE

Case IV: Unknown Estimated Release Termination Time

Release Starts 3 hours after General Emergency declaration.   Release is actually terminated 8 hours after declaration

	Recommendation	Site Boundary Dose	2 Mile Dose	5 Mile Dose
GPUN	Evacuate 5 mile radius and shelter 10 miles downwind.	16.25 Rem TEDE	.325 Rem TEDE	.200 Rem TEDE
NRC	Evacuate 2 mile radius and 5 miles downwind. Shelter remaining area.	16.25 Rem TEDE	.325 Rem TEDE	.200 Rem TEDE
State	Evacuate 10 mile radius	25.0 Rem TEDE	.500 Rem TEDE	.250 Rem TEDE

Specific Assumptions for All 4 Cases:

Dose Rates in Rem/hr TEDE (after release has started)- Site Boundary = 5.00; 2 Miles = .100; 5 Miles = .050

Meteorological conditions- "A" Stability, Southwest winds at 5 mph.   It is a winter weekday with normal weather.

PROTECTIVE ACTION RECOMMENDATION (PAR) LOGIC DIAGRAM BASIS

Background-

Prior to 1991, guidance on how to develop a PAR was limited to providing evacuation times estimates for the full 10 mile Plume Exposure Pathway Emergency Planning Zone (EPZ), requiring that the user consider projected exposure to be received if sheltered vice evacuated, and a requirement to apply the "Keyhole" concept. This limited guidance caused considerable confusion and lack of consistency on the part of the users. One of the biggest problems dealt with determining the radius to evacuate if the General Emergency was based on potential failures. In such cases, the dose projections based on current conditions were often fairly low since core damage had not yet occurred, and the dose projections based on projected core damage were very speculative. As a result, in 1991 TMI Emergency Preparedness revised its PAR Logic Diagram Procedure to provide a more user-friendly procedure that offered more definitive guidance. In developing this procedure, the department received considerable advice from the users themselves, namely the Emergency Directors, the Emergency Support Directors, and the Group Leaders Radiological and Environmental Controls.

Considerations-

Pennsylvania Policy-
Pennsylvania's policy regarding evacuation is that if any area of the EPZ must evacuate, then the entire EPZ must evacuate. GPU Nuclear, as well as the other 3 Pennsylvania utilities with nuclear plants, has voiced concern with this policy. The Pennsylvania utilities tried unsuccessfully on several occasions to convince the State to rethink its position. (We have not given up on the issue. We are presently discussing this issue with the new administration.) There can certainly be times, particularly when the release duration is expected to be short and the release magnitude large, when such a policy imposes increased health risks to the public. On the other hand, if there is a longer, smaller release or significant lead time before the release, this recommendation is not detrimental. In such situations, it would be beneficial if the plant's PAR was similar to what the State would independently develop.

TMI Evacuation Time Estimates-
The estimated evacuation times listed in both the 1981 and 1994 Evacuation Time Estimate studies conducted for GPU Nuclear indicate there are dramatically different evacuation times for a 2 mile evacuation versus a 10 mile evacuation. A 2 mile evacuation was estimated to take between 2 1/2 to 3 hours while a 10 mile evacuation could range from 6 to 12 hours depending upon the given condition.

The highly variable and lengthy evacuation times can make the decision process as to whether to evacuate or shelter more complicated than at a site with a smaller population density and thus shorter evacuation times. For example, at TMI just extending the downwind sectors out to 5 miles from a two mile radius evacuation could lengthen the evacuation time from 2 1/2 hours to nearly 8 1/2 hours depending upon the conditions and sectors affected. On the other hand, it might only lengthen it 10 minutes. (Table 6.1, page 6-2 "Evacuation Travel Time Estimates for the Three Mile Island Nuclear Generating Station Plume Exposure Pathway Emergency Planning Zone" February 1994)

Dose Projections- ,
A major concern prior to 1991 was what dose projection to use if the recommendation was being made based on deteriorating plant conditions. As was pointed out in NRC presentations, dose projections under such situations are highly suspect. It requires estimating variables such as time to containment failure, release duration, and extent of core damage. Since the damage has not yet occurred it is not likely we could accurately estimate those variables. Therefore, limiting the recommended evacuation radius based on a suspect dose projection does not seem very prudent.

In all likelihood, our General Emergency declaration will be based on deteriorating plant conditions rather than dose projections. (This was the case in the 1995 TMI Biennial Exercise.) Once we recognize that we are moving towards the necessary core damage and potential containment failure that could result in exceeding the Environmental Protection Agency's Protective Action Guidelines (PAGs), we have approximately 15 minutes to determine an appropriate PAR. At this point, there is likely to be very limited data. We don't feel it is wise to delay our recommendation for a dose projection that would need to be based on anticipated conditions. Instead, we assume that all areas downwind of the release have the potential of exceeding the PAGs. Since we know protective actions are required, we can concentrate our efforts on the appropriate recommendation, namely the option that would result in the least dose to the public. In other words, we are concentrating our efforts on trying to determine how long until the release might stop, something we feel we might be able to predict, rather than delaying our recommendation to try to estimate exactly when the release might start and what the extent of core damage might be. By concentrating on release termination time, we can better determine how much of the EPZ we should recommend to evacuate. In short, at a General Emergency, we will recommend evacuating as much of the EPZ as possible so long as it will not result in someone receiving more dose than he would get if he shelters.

Even after damage has occurred, accurate dose projections can be difficult. Until samples are taken, assumptions need to be made on how much core damage has occurred and what is the exact isotopic makeup of the release. Again, in a situation where there would be sufficient time to complete the evacuation, limiting the evacuation radius based upon a dose projection that indicated areas outside 5 miles may not exceed the EPA's Protective Action Guidelines (PAGs) does not seem prudent.

To summarize, our dose projection model will project doses as accurately as possible. Certainly, the dose projections would be used to help us classify an event. And certainly if the dose projections would indicate an area might exceed the PAGs and we hadn't already come to that conclusion based on plant conditions, then we would provide the appropriate recommendation based on the dose projection. However, we realize the limitations and the possible uncertainties of this model. RTM-92 emphasizes the large uncertainties in dose projections on pages C-6, D-2, H-2, 3, 4, 6, and 7. Hence, once we have determined that protective actions are required, either through the dose projection process or plant conditions, then we will recommend evacuating all areas in which evacuation would result in less dose than sheltering thereby removing the reliance on potentially suspect dose projections.

Guiding Principles-

In developing the diagram, we took into consideration State policy, the long evacuation times, and the potential uncertainties in the dose projection process. We felt that the diagram should fulfill the following requirements:

- The recommendation, as best we can determine, should result in the least dose to the public, and it should maximize the protection for those most at risk.

- It should be consistent with the guidance provided by the Environmental Protection Agency. (Note: While this procedure was originally developed before the publication of EPA 400, it has been reviewed to verify consistency with that document.)

- It should, as much as possible, be consistent with the generic guidance provided by the Nuclear Regulatory Commission. However, it should be GPU Nuclear's best recommendation based on all of the data available as opposed to strictly following generic guidance. (Note: This procedure was originally developed prior to RTM-92. The guidance used, which came from NRC presentations, was later published in RTM-92. When RTM-92 was published, a review of the diagram was conducted to verify that it still met the intent of the principles of RTM-92.)

- It should recognize that we can have long evacuation times. Therefore, it should take advantage of whatever lead time is available.

- It should be as consistent with the State as possible as long as it results in the least dose to the public and maximizes the protection for those most at risk.

- It should be simple and accurate, and it should be able to be determined quickly so that it can be provided in the 15 minutes available.

- It should provide consistent results from user to user.

Assumptions-

Evacuation Time Estimate Studies (ETEs) -
It was assumed that the ETE conducted for GPU Nuclear gave reasonable estimations for the length of time to evacuate. A minimum of 2.5 hours would be required to complete the evacuation of the 2 mile radius, and depending upon conditions, it could take as long as approximately 12 hours to evacuate the full EPZ.

Release Termination Time-
It was assumed that there can be situations when the release termination time can be conservatively estimated.

It should be pointed out that we are actually dealing with release termination time and not release duration. Referring to EPIP-TMI-.27, "Emergency Operations Facility," Revision 5, NRC Inspection Report No. 50-289/95-05 states under section 7.2 that "The discriminator between the recommendation of evacuation of an area vs. sheltering is the release duration." Technically, this is not true. The procedure actually uses the time from General Emergency declaration until the time the release is estimated to stop. The difference is significant if the General Emergency declaration is based on deteriorating plant conditions rather than the release at that time (i.e., plant conditions rather than present dose projections).

Our method bases its release termination time on parameters we feel can be reasonably and accurately determined. We did not use release duration because one must know both the starting time and the stopping time. Determining the start time of a release would be extremely difficult because to make that determination one would have to accurately predict accident progression and containment performance, neither of which we would have any control over. However, there could be situations when we do have the ability to control when the release will stop. For example, if the release is through a leaking steam generator, we know that we can emergency isolate that generator at 300 degrees. A conservative estimate using cooldown rates can predict the termination time.

The inspection report asked that we identify procedures by which the operators will estimate release duration and the uncertainty associated with that duration. As stated earlier, we do not use release duration in the PAR process; we use release termination time. There are no formal procedures used to determine that time. Release termination time is based on experienced operator estimates of when the release can be terminated through equipment or plant manipulation. TMI-1 Abnormal Transient Procedure (1210-5, "OTSG Tube Leakage") provides formal guidance used to determine when a generator can be isolated or when we can go on decay heat removal. From there, the operators use reactor shutdown rates and cooldown rates to estimate that release termination time. The uncertainty associated with this estimate is generally plus or minus one half hour. This same estimate is used for the dose projections as well. The projections assume the release has already started resulting in its release duration equalling the PAR Diagram's release termination time. Hence, if we are unable to arrive at an appropriate release termination time, then we would also have inappropriate dose projections.

We recognize the critical role estimating the release termination time plays. We cover this importance in training. We consider a non-conservative release termination time to be a serious error similar to a non-conservative Emergency Action Level determination. We expect our operators to be properly trained and exercise good judgement. Certainly, any changes to conditions that would cause a change in the estimated release termination time would be substantial enough to require going to the beginning of the diagram (see step #4 of Tables 1-4 in Note 7.).

We stress to our Emergency Directors and Emergency Support Directors that they must be confident in the release termination time. If they are not, then they are to assume a release termination time of 8 hours. Eight hours was chosen as the typical time it would take to cool down to the point where a release could be terminated. An 8 hour release termination time would result in a minimum of a 5 mile evacuation except in 1 adverse weather situation where it would yield a 2 mile evacuation. In 75% of the possible situations, it would yield a 10 mile evacuation downwind.

Sheltering Protection Factors-
The procedure only credits sheltering with saving 1 hour worth of dose. The figure was originally arrived at through sheltering guidance that stated the types of homes in the TMI area would provide a 50% dose reduction for up to 2 hours. When EPA 400 was issued this sheltering assumption was examined and determined to still be appropriate. The typical house in the TMI area is a wood frame house with a basement. For external dose, EPA 400 suggests a Dose Reduction Factor of .6 for this type of house. Our minimum evacuation time is 2.5 hours. Two and a half hours of dose times the .6 factor equal one and a half hours of dose. This implies that over a 2.5 hour period the house will reduce the dose by 1 hour worth over what would have been received outside the house. Approximately the same figure would be arrived at for the inhalation dose if there is no credit for special preparations being taken. Theoretically, the protection offered by sheltering will be some number in excess of 1 hour dose savings for exposures in excess of 2.5 hours. However, as time goes on the protection sheltering offers becomes less and less significant. Our assumption of 1 hour worth of dose savings over a 2.5 hour period also appears consistent with the assumption RTM-92 Volume 2 uses on page 110 that a frame house provides a 1/2 reduction in total dose.

Plume Travel Time-
It was assumed that plume travel time would not have a significant effect in determining whether to evacuate or shelter. Plume travel time is highly variable and unpredictable. Furthermore, examination of wind speed characteristics around TMI have shown that winds are typically 5 miles per hour or greater. When winds do become very light (less than 3 mph) they rarely stay that light for more than an hour.

Ground Shine-
In determining whether to evacuate or shelter, there was no additional dose added to the sheltering case to cover the dose received if evacuated after the release had terminated. For the situations where sheltering would be considered (i.e., release termination time period of a few hours), the dose from ground shine will typically represent only a small fraction of the total dose received. It is true that there would still be dose delivered from ground shine after the release had stopped. However, if that dose were significant, those that were sheltered could then be evacuated. The additional ground shine dose received in that evacuation process would be more than compensated for by the additional dose savings, above the 1 hour credit already taken, that sheltering would actually offer.

Dose Comparisons-
Dose comparisons between the evacuation alternative and the sheltering alternative were conducted for the later evacuees who would be the most at risk. With the data we had available, we could not say how far from the plant the earlier evacuees would get before getting tied up in traffic.

For those closest to the plant, it was assumed that the evacuees would first get caught in traffic close to home. This assumption seems reasonable based on the ETE's conclusion that one of the places where queuing is expected to be most prevalent is along Route 441 (River Road which is the closest main road to the plant) (page 6-1 ETE). Conceptually, those that have the furthest to travel (those closest to the plant) would be the most likely to get caught in traffic, would get caught in that traffic closest to the site, and would be caught in traffic for the longest time. An analogous situation would be the exiting of a crowd from a football stadium. Those furthest from the exits are the most likely to be delayed, they would be delayed furthest from the exit, and they would be delayed for the longest time.

Qualitative Analysis-

Long Release Termination Times-
Long release termination times can result from either a release with a long release duration or an extended period of time before the release starts followed by a shorter release duration. In either case, at a General Emergency as a result of actual or projected doses exceeding the PAGs or because actual or expected plant conditions could result in a release that would exceed PAGs, the PAR Logic Diagram recommends evacuating a 5 mile radius and 10 miles downwind. Our definition of downwind sectors are those that we expect to be affected and the adjacent sectors (outside the 2 mile ring) during the course of the release. With very long release termination times, we are likely to conclude that all sectors are expected to be affected during the course of the release. Thus, our PAR will then match up with the State's. Such a match enables preplanned protective actions to be used. As RTM-92, Volume 2 page 196 points out when using preplanned protective actions, "The areas to be evacuated, the message to be used, the routes to be followed, are in place for fast implementation."

For this case, dose projections for some of the recommended evacuation area may not necessarily exceed EPA PAGs. Our reason for recommending that the area be evacuated anyway is that we have potentially long evacuation times. We know we have damaged fuel; so there is the potential for significant exposures. We need to take advantage of whatever time is available to us in case the dose projections turn out to underestimate actual dose.

Very Short Release Termination Times-
It is extremely difficult to foresee a situation where plant control has been lost to such an extent that core damage has occurred, and yet the plant has been cooled down to the point where any releases can be stopped in a very short period of time. However, good emergency preparedness calls for a plan to be developed for such a circumstance.

For evacuation of only the 2 mile radius, the primary delay in evacuation is the preparation and mobilization time. Most people (85%) would not be able to begin evacuating for the first hour and nearly half of the people (45%) will not begin until an hour and a half has passed (page 5-6, "Evacuation Travel Time Estimates for the Three Mile Island Nuclear Generating Station Plume Exposure Pathway Emergency Planning Zone" February, 1994). The inspection report justifies evacuating the public in short release durations situations based on the conclusion that "dose savings to other residents will be significant in that some portion of the population will have evacuated the affected area prior to plume passage." Based on our ETE for a 1 hour release termination time, our conclusion is that only 15% of the public might receive less dose while 85% would receive more. To us, such a situation would justify sheltering as an option.

An obvious concern is choosing a sheltering option when evacuation could be implemented. That is why the release termination time must be based on something the operators feel they have control over. There should be very little error when a very short termination time is chosen. Furthermore, in the short termination time situation, there should be fairly immediate feedback if the termination time turns out to have been estimated in the non-conservative direction.

For example, suppose that we lose all makeup capability during a primary to secondary leak in excess of 50 gallons per minutes while steaming through the condenser. There is no core damage at the time of the declaration, but incore thermocouples have indicated a slight superheat condition. Based on our EALs, we would declare a General Emergency. Now lets also suppose that the operators estimate, based upon their cooldown progress, that they will be able to isolate the leaking steam generator within one hour. Our PAR Logic Diagram procedure would suggest that they recommend sheltering the 2 mile radius and 10 miles downwind. If after this recommendation something then happened to change their ability to meet the one hour termination time, the same PAR Logic Diagram procedure would require them to return to the beginning of the diagram because there has been a substantial change in conditions (see step #4 in Tables 1-4 of Note 7.). The time between the initial and subsequent recommendations was not completely lost. Since the sheltering recommendation was given, some of the preparation and mobilization would have been accomplished. Therefore, the subsequent evacuation shouldn't take quite as long as it would have if there were no sheltering prior to the evacuation. Admittedly, this would not be the way we would prefer the sequence of events to occur, but because of the rather immediate feedback that would be available on the estimate for short termination times, the possible consequences are limited.

Now, take the case where we did properly estimate the release termination time of 1 hour, but our procedures required an automatic evacuation at the General Emergency. Lets also suppose that fuel damage and with a significant release occurs for that hour. Our ETE tells us that 85% of the people will not even have left their house in that 1 hour period. Instead, they are going in and out of their house, completely unprotected, preparing to evacuate because that was the recommendation they were given. We see the consequences of going with an automatic evacuation when it cannot be practically implemented as more of a risk than inaccurately estimating a conservative release termination time that was based on something the operators had control over.

Release Termination Times of Several Hours-
It is in this termination time frame that our diagram provides its most benefit. It provides the operator with meaningful information about what can practically be carried out. The population inside TMI's EPZ is approximately 175,000 people with at times an additional 30,000 transient population. This population is not evenly distributed around TMI. A large portion can be found in the northeast quadrant of the 2-10 mile ring. As was pointed out earlier, including this area in the evacuation recommendation significantly lengthens evacuation times. Just including the 2-5 mile area of this quadrant can sometimes significantly alter the evacuation time. Adding this area based on a default recommendation of 2 mile radius and 5 miles downwind or because suspect dose projections indicate a possibility of exceeding the EPA PAGs can have serious consequences on those most at risk, namely those residing in the 2 mile ring. Therefore, before we recommend evacuating out to 5 or 10 miles, we would like to believe that such an action will result in those people receiving less dose then if they had sheltered.

If we believe that an area cannot be completely evacuated before the time we have conservatively estimated that the release will stop, then we will recommend sheltering areas further out in order to expedite the evacuation of those areas nearest the site. With longer release termination times, larger evacuation areas can be recommended.

This system provides a well defined method to maximize the protection for those most at risk. Since the evacuation times are relatively short for the 2 mile radius, it is highly likely that our PAR will recommend that they evacuate. If more time is available, we take advantage of that time by evacuating a larger area. And, if sufficient time is available, our recommendation would closely match the State's policy. The significant advantage of this system is that it provides the Emergency Directors and Emergency Support Directors with clear guidance on what to do in the limited release termination time situation.

An example can help illustrate the advantage of our system. Assume that there is a primary to secondary leak with insufficient makeup capability. Secondary side cooling capabilities somewhat degraded. However, the emergency response organization has determined that y can get the plant on the Low Pressure Injection (LPI) System in 4 hours. The wind is blowing into Sector 1 (the north-northeast sector). It is a weekday with normal weather. Assume that core damage occurs 3 hours after declaration and lasts for one hour until the plant is placed on LPI. Assume that the dose near the site is 100 Rem TEDE for that 1 hour. Depending upon release pathway and meteorological conditions, it is certainly possible that the doses could be a factor of 100 less at 2 miles. Our recommendation would be to evacuate the 2 mile radius and shelter 10 miles downwind. This would result in no dose to those inside 2 miles because they would have been able to complete their evacuation prior to plume arrival. The dose received by those outside 2 miles would be about one half of the dose they could have received if they had evacuated. In this example, it would be something less than 500 mRem. On the other hand, suppose we had tried to evacuate out to 5 miles, either because it was an automatic requirement or because dose projections indicated that those outside 2 miles could exceed 1 Rem. Those near the site could then receive up to 100 Rem since now they would be caught in traffic on Route 441 while those outside 2 miles could receive up to 1 Rem. We see our procedure having the benefit of providing substantial dose savings and the avoidance of early health effects. If there were 10 Rem at 2 miles, the potential doses near the site could be 1000 Rem making our methodology even more appropriate.

Unknown Release Termination Time-

In a relatively fast-breaking event, the operators may not know exactly how long it will be before they can stop the release. They may be in the process of working on that information when the General Emergency is declared, but they have insufficient data to make an accurate estimate. In such a situation, the procedure has them use a default value of 8 hours. Eight hours was chosen because it represents the typical times it has taken to get the plant fully cooled down. It also provides a reasonable initial protective action recommendation. An 8 hour release termination time will result in a minimum of a 5 mile evacuation except in one adverse weather situation where it yields a 2 mile evacuation. In 75% of the possible situations, it will result in a 5 mile radius and 10 miles downwind evacuation.

The inspection report felt that this recommendation appears in conflict with EPA-400 in that it would be possible for areas that were sheltered to receive in excess of 10 Rem and not even be considered for evacuation. This is untrue. By definition, there must be a substantial change in conditions after 8 hours. Either the release has been terminated or the evacuation has been completed. In either case, it requires the operator to go back to the beginning of the diagram. Since our basic premise that is taught to all of the Emergency Directors and Emergency Support Directors is to evacuate all of the potentially affected areas that can complete their evacuation prior to the release termination, the release termination time should be adjusted to the known time or by an additional 8 hours if unknown. In either case, a new recommendation would be made. Again, the additional area would be made based upon the new total termination time. Hence, if sufficient time is available, the previously sheltered area would then be evacuated.

It should be pointed out that in developing this response to the inspection report it was found that there is a place where some word changes would improve the diagram. On step 2 of Tables 1-4 of Note 7, it says, "Determine "X", which equals the number of hours from NOW until the current or projected release is estimated to STOP. If it is unknown when the release will stop, assume "X" =8." The word, "NOW", was chosen to ensure that the operators took advantage of any lead time prior to the commencement of the release. It is obvious to us that for the tables to work properly when they are revisited the user must count the time that has already passed since the first recommendation. For clarity, the wording should be changed to ensure that the total release termination time is used. The procedure will be revised to change the word, "NOW" to "the time of the General Emergency declaration."

Deviations from Procedure-

The procedure tries to anticipate all of the possible situations. However, we recognize that it is possible that, given a totally unique and unanticipated scenario, the procedure may give an answer the Emergency Director or Emergency Support Director feels is inappropriate. To cover such cases, there is a note in the procedure that gives them the latitude to exercise good judgement and deviate from the procedure's answer if necessary.

EPA-400-

The inspection report questions whether this diagram conforms to the guidance set forth in EPA-400, "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents." While the original diagram was developed under the guidance issued by the EPA prior to EPA-400, it was carefully reviewed against EPA-400 to ensure it was consistent with the new guidance. Some modifications were made at that time. However, our basic philosophy was already consistent and did not need to be changed.

EPA-400 says, "Sheltering may be the preferred protective action when it will provide protection equal to or greater than evacuation, based on consideration of factors such as source term characteristics, and temporal or other site-specific conditions." A significant portion of our PAR Logic Diagram procedure is devoted to conducting the evaluation of which, sheltering or evacuation, offers the greatest protection. Section 5.5 of the manual goes into a more detailed discussion of the merits of sheltering versus evacuation. Page 5-18 of the manual provides guidance on how to make a determination on whether sheltering or evacuation is the preferred protective action. In developing our diagram, we took into consideration the items listed such as, "population distribution, the sheltering effectiveness of residences and other structures, institutions containing population groups that require special consideration, evacuation routes, logical boundaries for evacuation zones, transportation systems, communication systems, and special problem areas." Long evacuation times result in the same problems as long mobilization times as described in 5.5.2 #4 on page 5-19. EPA 400 recognizes this when they say, "it (sheltering) may be the temporary protective action of choice if rapid evacuation is impeded by physical constraints to evacuation (e.g. inadequate roads)" (5.5.3 #7, bottom of page 5-21 and top of page 5-22.)

We also noted the comment in section 2.3.1 of the manual where it says, "However, reliance on large dose reduction factors for sheltering should be accompanied by cautious examination of possible failure mechanisms, and, except in very unusual circumstances, should never be relied upon at projected doses greater than 10 Rem." Unlike the inspection report, we do not read that statement to say that sheltering cannot be used for situations where there are dose projections greater than 10 Rem. Instead, one should not assume large dose reduction factors to justify sheltering when dose projections are greater than 10 Rem. Our methodology only assumes very conservative dose reduction factors.

We see the situations where we could potentially recommend sheltering an area where dose projections exceed 10 Rem as very rare. The first would be an extremely high dose rate puff release. For very short time periods, an evacuation recommendation could result in the majority of people receiving significantly more dose than if they had sheltered. We interpreted such a situation as "an unusual circumstance".

The second situation would occur if we limited the evacuation area due to the short release termination time. For example, assume that our release termination time caused us to only recommend evacuating the 5 mile radius and shelter 10 miles downwind even though our dose projections indicate areas outside 5 miles may exceed 10 Rem. In such a situation, the area inside the 5 mile radius has the potential for doses much greater than 10 Rem. Furthermore, attempting to evacuate the full 10 miles could result in those living in the

5-10 mile ring getting more dose than they would get if they sheltered since they may not be able to complete their evacuation prior to release termination time. We do not believe it is the intent of EPA-400 to require us to evacuate an area that we are estimating might receive 10 Rem based on a dose projection with potentially large uncertainties if such a recommendation would result in others getting lethal doses, especially if such a recommendation could result in all areas receiving more dose. Again, we see such a situation as "an unusual circumstance."

Conclusion-

The inspection report also incorrectly assesses the diagram as being insensitive to specific dose projection results. Clearly, any dose projection in excess of EPA guidance will result in a protective action recommendation if one has not already been taken based upon plant conditions. The difference is that once we know we have the potential to exceed the PAGs we do not limit our recommendation based upon a potentially suspect dose projection. Instead, we evacuate unless sheltering results in being the preferred protective action because it provides "protection equal to or greater than evacuation, based on consideration of factors such as source term characteristics, and temporal or other site-specific conditions." We will always evacuate an area of projected dose of 10 Rem unless there are unusual circumstances. The difference is that we do not necessarily wait for that dose projection. If it made sense to evacuate, we would have taken that action. We realize that our procedure is sensitive to evacuation times and estimated release termination times. However, because of the uniqueness of our evacuation times, we felt our recommendation should be sensitive to them. And all recommendations based on dose projections are already sensitive to being able to estimate that release termination time. We feel there are circumstances when we can make an accurate determination of that time, and if not, we have a reasonable default value. By concentrating our efforts on release termination time, we are focusing on a parameter that we are more likely to have some control over and some experience in determining.

We cannot say the same about many of the other parameters that go into the dose projection process such as estimating core damage or isotopic mix in a severe core damage situation. We believe that our procedure not only meets EPA-400 guidance, but more importantly, provides a recommendation that gives the least dose to the public and maximize the protection for those most at risk around TMI.