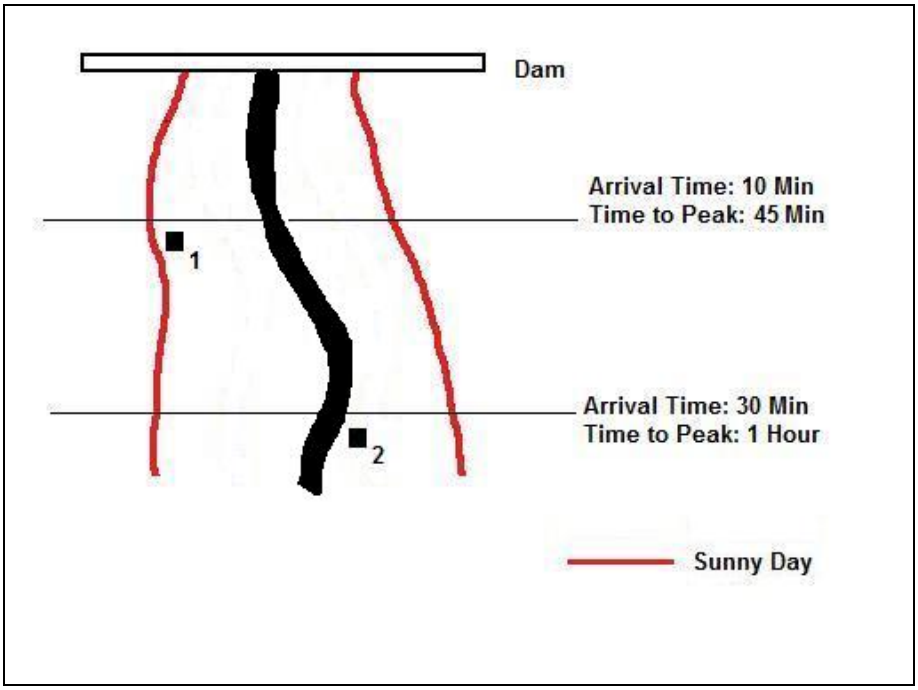
METHOD FOR ASSESSING TIME-SENSITIVE EAPS

This document describes a method for assessing time-sensitive Emergency Action Plans (EAPs). The method – called a Sudden Failure Assessment - conservatively assumes a sudden, unexpected failure of the dam with no pre-warning to the licensee.

SUDDEN-FAILURE ASSESSMENT

(A) Determine Time to Impact – The time to impact is the amount of time it would take for a flood wave from a dam failure to significantly impact the first non-project downstream structure (e.g., residence, campground, business, etc.) based on the fair weather/sunny day inundation zone in the EAP.

As an example, the figure below shows the area downstream of a dam from the EAP's inundation map. Structure 1 is located at an elevation near the fair weather/sunny day inundation line. It would likely receive impacts just before the Time to Peak – which is about 45 minutes – and only be impacted by a few inches of water from a failure. Structure 2 is close to the river's edge and at an elevation that would receive significant impacts close to the arrival time - which is about 30 minutes. Based on this map, the licensee estimates the time to impact for the nearest structure is 30 minutes.



(B) Determine Detection Time – The detection time is the amount of time after the sudden failure begins until the licensee's staff is aware there is a problem at the dam. Typically, this warning is triggered by instrumentation at the project. If the site is unmanned during part of the day, the detection time should conservatively be estimated for non-working hours when operators would be warned through communication systems such as autodialers. Where possible, time estimates should be based on actual tests of the instrumentation and communication systems.

In the example, an unexpected failure of the dam during non-working hours would trigger the headwater and tailwater sensors. When these sensors are triggered, an autodialer calls the nearest operator and project manager. The headwater sensor is currently set to alarm if there is a 2 foot drop within 10 minutes and the tailwater sensor is set to alarm if there is a four foot rise within 10 minutes. Based on a test of the system, the licensee determines the total detection time - including the time for the sensors to trigger and the call to be received by project personnel - is about 14 minutes.

(C) Determine Verification Time – The verification time is the amount of time to verify a problem at the dam, either visually or by other means, once the problem has been detected. If the site is unmanned during part of the day, the verification time should conservatively be estimated for non-working hours. The verification time should be based on actual tests or drills for the amount of time it takes to have someone confirm a problem.

In the example, the project's instrumentation triggers an autodialer to call the operator and project manager. A test was performed to determine how long it takes the operator to get to the site initiated by an unannounced call to the operator's home. The test revealed it took the operator 23 minutes to reach and inspect the dam.

(D) Determine Notification Time – The notification time is how long it would take to notify the local emergency management agency (EMA) after a problem is verified. This includes any internal discussion among licensee personnel before the EMA is notified. The notification time can be estimated from the call down test performed during the annual drill.

In the example, the operator visually verifies a problem at the dam and calls the project manager to explain what is happening at the dam. The project manager then decides to activate the EAP and contacts the local EMA according to the notification flow chart. During the most recent call down test, it took 8 minutes from when the operator called the project manager to when the project manager completed her discussion with the local EMA.

(E) Calculate Licensee's Total Response Time – The licensee's total response time is the amount of time to detect, verify, and notify the EMA of an emergency. This is the sum of steps B, C, and D.

Step	Time (min)
B	14
C	23
D	8
E	45

(F) Get Estimate of EMA's Response Time – The EMA's response time is how much time the local EMA needs to warn and/or evacuate the critical residences close to the dam. This can be asked during the annual orientation/meeting with the local EMA.

In the example, the EMA indicates first responders would need at least 20 minutes as a lead time in order to warn and/or evacuate the two closest houses within the inundation zone. The other structures within the inundation zone are further downstream and would be able to be evacuated before the flood arrives in those areas.

(G) Calculate Excess Response Time – The excess response time is the difference between the time to impact and the sum of the licensee's and EMA's response times (A – (E + F)). If the excess response time is negative, there is not enough time to warn and evacuate people before the flood wave arrives. If the excess response time is positive, then the amount of time for an emergency response should be adequate.

Step	Time (min)
A	30
E	45
F	20
A – (E + F)	-35

(H) Assess Results – If the excess response time in step G is negative, try to come up with methods to decrease the detection, verification, and notification times that would yield positive values. Even if the excess response time is positive, it may still be beneficial to take additional measures to maximize the chance of safely warning and evacuating all downstream residents during an emergency.

The goal is to get the excess response greater than zero. If all options to decrease the detection, verification, and notification times have been considered and the excess response time is still negative, the only possibility for saving additional time is with the EMA's response. In these cases, coordinate with the local EMA to determine if anything can be done to decrease the EMA response time through enhanced warning systems, public education, etc.

For some projects with residences directly downstream, it may be impossible to get positive excess response times. For these projects, the goal should be to get an excess response time as close to zero as possible.

In the example, the following enhancements were made to the licensee's system:

Enhancement	Time Parameter Impacted	Benefit
Adjust trigger points on headwater/tailwater levels to activate sooner.	Detection	Quicker detection.
Install internet-accessible cameras pointed at headwater and tailwater staff gages.	Verification	Eliminates drive to dam to verify emergency.
	Notification	Allows project manager to activate EAP without talking to operator. Provides redundancy if operator is unavailable.
Operator will contact EMA directly if failure is evident.	Notification	Allows operator to activate EAP without talking to project manager. Provides redundancy if project manager is unavailable.
Create Pre-Scripted Messages for Project Manager/Operator to inform local EMA of emergency.	Notification	Allows project manager/operator to give EMA all information they would need as quickly as possible.

The proposed changes would decrease the licensee's response time but the excess response time would still remain negative:

Step	Time Parameter	Time (min)
A	Time to Impact	30
B	Detection Time	10
C	Verification Time	5
D	Notification Time	5
E	Licensee Response Time (B + C + D)	20
F	EMA Response Time	20
G	Excess Response Time (A – (E + F))	-10

At this point, the licensee coordinated with the local EMA to determine if additional measures could be made to decrease the EMA response time. The EMA and licensee agreed to keep contact information for the two critical houses in the EAP and both the licensee and EMA will call the residents during an emergency. Each year, the residents are given evacuation procedures to follow if they ever notice a problem or receive a call. The additional measures decrease the EMA response time to yield a positive excess response time.