Additions from previous version are shown in blue, and deletions are ~~red strikethrough~~.

FRS

1.2.13 Recovery Functionality (new section)

The NPAC SMS provides a mechanism that allows a Service Provider to recover messages sent to either the SOA or LSMS, during a period of time that the Service Provider was not available to receive messages from the NPAC SMS. This recovery mechanism (also referred to as resynchronization) is initiated when a Service Provider's SOA or LSMS re-associates to the NPAC SMS, by setting the recovery mode indicator to TRUE on the Access Control structure, then requests the recovery of missed messages, by requesting the missed Network Data, Subscription Versions, and Notifications.

The SOA requests network data and notification data for a specific period of time from the NPAC SMS, which is sent by the NPAC SMS as requested. During the recovery process, new messages are queued on the NPAC SMS. Additionally, during the recovery process, the "3 by x" retry functionality continues on the NPAC SMS, but message sending is suspended to the SOA, and the retry attempts counter is not decremented, as long as the SOA is still in recovery mode. Once the recovery is finished, the SOA sends a recovery complete message to the NPAC SMS, which in turn triggers the NPAC SMS to send the previously queued messages to the SOA, at the next normally scheduled retry interval. At the completion of sending the previously queued messages, the interaction between the SOA and the NPAC SMS resumes for normal message processing.

The LSMS recovery functionality works similar to the SOA, with the addition of recovering subscription data.

6.8 Network Data Recovery (new section)

Req 1 Network Data Recovery

NPAC SMS shall provide a mechanism that allows a SOA or LSMS to recover network data downloads that were missed during a broadcast to the SOA or LSMS.

Req 2 Network Data Recovery – Order of Recovery

NPAC SMS shall recover all network data download broadcasts~~, failed or successful,~~ in time sequence order when network data recovery is requested by the SOA or LSMS.

Req 3 Network Data Recovery – Time Range Limit

NPAC SMS shall use the Maximum Download Duration Tunable to limit the time range requested in a network data recovery request.

Req 4 Network Data Recovery – SOA and LSMS Independence

NPAC SMS shall support the recovery of network data for the SOA and LSMS as independent requests.

Req 5 Network Data Recovery – SOA Network Data

NPAC SMS shall allow the SOA to only recover network data downloads intended for the SOA.

Req 6 Network Data Recovery – LSMS Network Data

NPAC SMS shall allow the LSMS to only recover network data downloads intended for the LSMS.

Req 7 Network Data Recovery – Network Data Criteria

NPAC SMS shall allow the following network data download criteria:

- time-range (optional)
- Single Service Provider or all Service Providers

Req 8 Network Data Recovery – Network Data Choices

NPAC SMS shall require one of the following network data download choices:

- npa-nxx-data (with one of the two selections below)
  - npa-nxx-range
  - all
- lrn data (with one of the two selections below)
  - lrn-range
  - all
- all network data

6.9 Subscription Data Recovery (new section)

Req 1 Subscription Data Recovery

NPAC SMS shall provide a mechanism that allows an LSMS to recover subscription data downloads that were missed during a broadcast to the LSMS.

Req 2 Subscription Data Recovery – Order of Recovery

NPAC SMS shall recover subscription data download broadcasts in time sequence order when subscription data recovery is requested by the LSMS.

Req 3 Subscription Data Recovery – Time Range Limit

NPAC SMS shall use the Maximum Download Duration Tunable to limit the time range requested in a subscription data recovery request.

Req 4 Subscription Data Recovery – Subscription Data Choices

NPAC SMS shall require an LSMS to specify one of the following choices in a subscription data recovery request:

- time-range
- tn
- tn-range (NPA-NXX-xxxx) – (yyyy)

Req 5 Subscription Data Recovery – Full Failure SV

NPAC SMS shall exclude Subscription Versions with a status of failed, when subscription data recovery is requested by the LSMS.

Req 6 Subscription Data Recovery – SV Timestamp for Requested Time Range

NPAC SMS shall use the Subscription Version's Broadcast Timestamp value to determine if an SV falls within the requested time range for a subscription data recovery request.

Req 7 Subscription Data Recovery – Removal of Service Provider from Failed List

NPAC SMS shall remove a Service Provider from the Failed SP List of an SV, upon successful recovery of the subscription data.

Req 8 Subscription Data Recovery – Successful Recovery of SV Data and Removal of Service Provider from Failed List – Both Service Providers

NPAC SMS shall send, to the Old and New Service Providers, the status and a list of all Local SMSs that currently exist on the Failed SP List of an SV, upon successful recovery of the subscription data, with the exception of modify active or disconnect requests.

Req 9 Subscription Data Recovery – Successful Recovery of SV Data and Removal of Service Provider from Failed List – New Service Provider Only

NPAC SMS shall send, to the New Service Provider only, the status and a list of all Local SMSs that currently exist on the Failed SP List of an SV, upon successful recovery of the subscription data, specific to modify active or disconnect requests.

IIS

5.3.4 Recovery (updated section), existing text is shown below:

> The SOA and Local SMS associations are viewed to be permanent connections by the NPAC SMS. Thus when the association is broken for any reason, the system connecting to the NPAC SMS must assume responsibility to recover and resynchronize themselves with the NPAC SMS. One association should be established for recovery and no other associations should be established in normal mode until recovery is complete.

New text is shown below (which immediately follows the above text):

During the recovery process, other messages may be generated at the NPAC SMS that are intended for the recovering SOA or LSMS. These messages are queued on the NPAC SMS until the SOA or LSMS finishes the recovery process and sends an lnpRecoveryComplete action to the NPAC SMS. Additionally, during the recovery process, the "3 by x" retry functionality continues on the NPAC SMS, but message sending is suspended to the SOA or LSMS, and the retry attempts counter is not decremented, as long as the SOA or LSMS is still in recovery mode. Therefore, a Subscription Version could stay in a "sending" status for a period of time longer than expected, since the retry logic will not transition the status to "partial failure" or "failed" as long as a Service Provider is in recovery mode.

While recovering subscription data, the NPAC SMS excludes Subscription Versions with a status of failed. The value in the Broadcast Timestamp field in each Subscription Version is used to determine whether or not a Subscription Version is included in the recovering LSMS's requested criteria.

~~The SOA or LSMS is capable of recovering data based on the specific association function for network data download (SOA) and network and subscription data download (LSMS), as specified in the initial association request to the NPAC SMS.~~

The SOA or LSMS is capable of recovering data based on the association functions. The SOA recovers network data and notification data using the network data management association function (networkDataMgmt). The LSMS recovers network data and subscription data using the data download association function (dataDownload), and recovers notification data using the network data management association function (networkDataMgmt).

5.3.4.1 Local SMS Recovery (existing section, no changes)

> To recover, the Local SMS starts by setting the recoveryMode flag of the access control parameter. This flag signals the NPAC SMS to hold all data updates to this Local SMS. The Local SMS should then request the network and subscription data downloads and the notifications that occurred during downtime. Once this is complete, the Local SMS should issue the lnpRecoveryComplete action to turn off the recoveryMode flag. After the NPAC SMS responds to the lnpRecovery Complete action it will send to the LSMS any other messages that have occurred since the association was established.

5.3.4.2 SOA Recovery (existing section, no changes)

> To recover, the SOA starts by setting the recoveryMode flag of the access control parameter. This flag signals the NPAC SMS to hold all data updates to this SOA. The SOA should then request the network data downloads and notifications that occurred during downtime. Once this is complete, the SOA should issue the lnpRecoveryComplete action

to turn off the recoveryMode flag. After the NPAC SMS responds to the lnpRecovery Complete action it will send to the SOA any other messages that have occurred since the association was established.

B.7 Local SMS and SOA Recovery (new text is shown in *larger print italics*)

B.7.1 Sequencing of Events on Initialization/Resynchronization of Local SMS

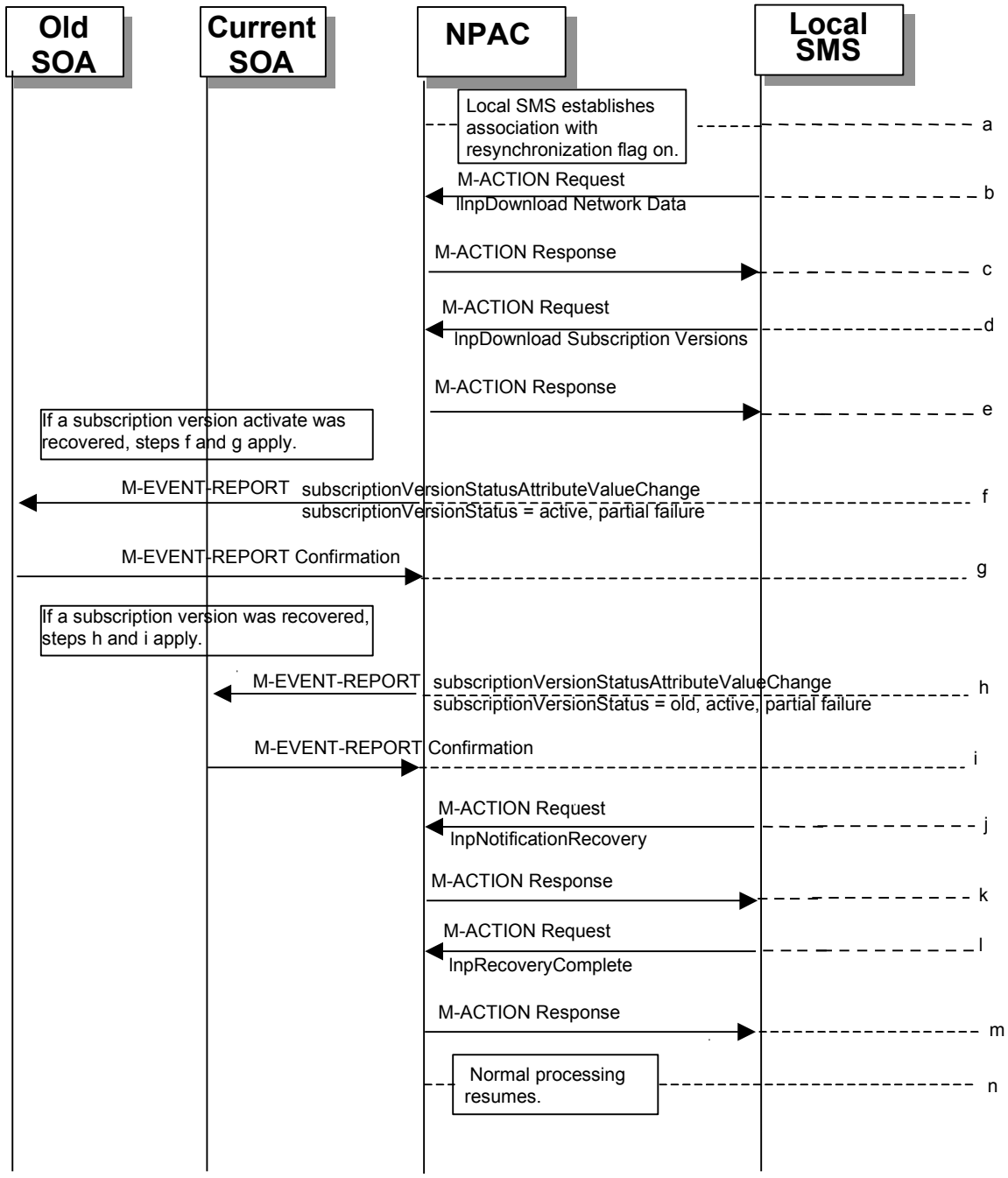
If the resynchronization flag is TRUE upon association establishment, the NPAC SMS will hold updates to the Local SMS until the flag is turned off. At that time all updates issued since the association establishment will be sent, *at the next normally scheduled retry interval.*

For all download requests in this scenario, the Local SMS should behave as follows in response to the possible download M-ACTION response from the NPAC SMS: ~~If any of the requests in this scenario fail, the Local SMS must correct the problem - retry the action instead of continuing~~

- *Success – process the data received from the NPAC SMS, continue processing.*
- *No-data-selected – no data was found, continue processing.*
- *Criteria-too-large (using the Maximum Number of Download Records tunable) – break up the request into a smaller time range and re-issue the request to the NPAC SMS (only applies to SV requests).*
  OR
  Criteria-too-large (using the Maximum Number of Download Notifications tunable) – break up the request into a smaller time range and re-issue the request to the NPAC SMS (only applies to notification requests).
- *Time-range-invalid (using the Maximum Download Duration tunable) – break up the request into shorter time ranges and re-issue the request to the NPAC SMS.*
- *Failed – go into retry mode. Re-issue the request* ~~*two*~~ *a configurable number of additional* ~~*times*~~ *retry attempts with an "x"* ~~*minute*~~ *amount of delay between requests ("x" is based on a configurable amount of time after receiving the failure for each request). If a failed response is received for the* ~~*third*~~ *final retry request, abort the association and re-start the recovery process. Note: It is* ~~*assumed*~~ *recommended that the Local SMS* ~~*would*~~ *use the same value that the NPAC SMS uses for retry interval. It is also recommended that the Local SMS use a value of at least two (2) for configurable number of additional retry attempts.*

For activities that specify "continue processing", the Local SMS should send the NPAC SMS, either the next lnpDownload Action for a different type of data, or an lnpRecoveryComplete request, depending on where the response appears in the flow.

This is an optional flow for the Local SMS. It is also optional as to whether the Local SMS recovers Network Data, Subscription Data, Notification Data, or any combination of the three. Assuming the Local SMS initiates recovery, the only step that is required is the lnpRecoveryComplete message, at the end of all previous data recovery requests. This instructs the NPAC SMS to send previously queued messages, at the next scheduled retry interval, and resume normal processing.



a. Local SMS establishes association with resynchronization flag on*, along with network data management (networkDataMgmt) and data download (dataDownload) association functions set.*

b. Local SMS sends M-ACTION to start network data download. The Local SMS specifies the criteria.

c. NPAC SMS responds to M-ACTION with updates.

d. Local SMS sends M-ACTION to start subscription data download. The Local SMS specifies the criteria.

e. NPAC SMS responds to M-ACTION with subscription version updates.

f. If any corrections were issued to the resyncing Local SMS, the NPAC SMS will send the M-EVENT-REPORT to the old service provider SOA of the subscriptionVersionStatus change and a list of failed Local SMSs (minus the resyncing Local SMS that no longer contains a discrepancy).

g. The old service provider SOA confirms the M-EVENT-REPORT.

h. If any corrections were issued to the resyncing Local SMS, the NPAC SMS will send the M-EVENT-REPORT to the current service provider SOA of the status change and a list of failed Local SMSs (minus the resyncing Local SMS that no longer contains a discrepancy).

i. The current service provider SOA confirms the M-EVENT-REPORT.

j. Local SMS sends M-ACTION to recovery notifications by time range.

k. NPAC SMS responds to M-ACTION with notification updates.

l. Local SMS sends M-ACTION to set resynchronization flag off.

m. NPAC SMS replies to the M-ACTION.

n. Normal processing resumes and any activity that the NPAC SMS had queued up during the recovery period will now be sent*, at the next scheduled retry interval*.

B.7.2 Sequencing of Events on Initialization/Resynchronization of SOA

If the resynchronization flag is TRUE upon association establishment, the NPAC SMS will hold updates to the SOA until the flag is turned off. At that time all updates issued since the association establishment will be sent, *at the next normally scheduled retry interval*.

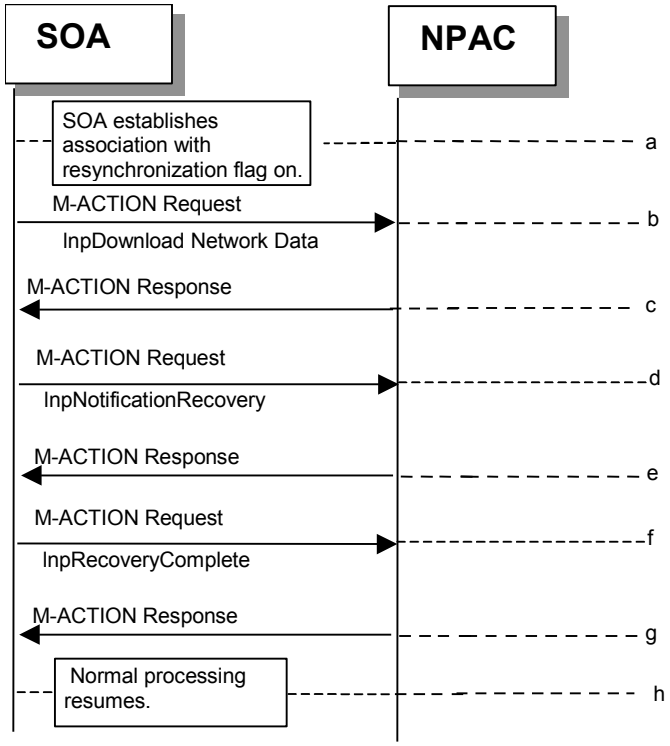
For all requests in this scenario, the suggested SOA behavior is as follows: ~~If any of the requests in this scenario fail, the SOA must correct the problem - retry the action instead of continuing.~~

- *Success – process the data received from the NPAC SMS, continue processing.*
- *No-data-selected – no data was found, continue processing.*
- *Criteria-too-large (using the Maximum Number of Download Notifications tunable) – break up the request into a smaller time range and re-issue the request to the NPAC SMS (only applies to notification requests).*
- *Time-range-invalid (using the Maximum Download Duration tunable) – break up the request into shorter time ranges and re-issue the request to the NPAC SMS.*
- ~~*Failed – go into retry mode. Re-issue the request two additional times with an "x" minute delay between requests. If a failed response is received for the third retry request, abort the association and re-start the recovery process. Note: It is assumed that the SOA would use the same value that the NPAC SMS uses for retry interval.*~~
- *Failed – go into retry mode. Re-issue the request ~~two~~ a configurable number of additional ~~times~~ retry attempts with an "x" ~~minute~~ amount of delay between requests ("x" is based on a configurable amount of time after receiving the failure for each request). If a failed response is received for the ~~third~~ final retry request, abort the association and re-start the recovery process. Note: It is ~~assumed~~ recommended that the Local SMS ~~would~~ use the same value that the NPAC SMS uses for retry interval. It is also recommended that the Local SMS use a value of at least two (2) for configurable number of additional retry attempts.*

For activities that specify "continue processing", the SOA should send the NPAC SMS, either the next lnpDownload Action for a different type of data, or an lnpRecoveryComplete request, depending on where the response appears in the flow.

This is an optional flow for the SOA. It is also optional as to whether the SOA recovers Network Data, Notification Data, or both. Assuming the SOA initiates recovery, the only step that is

required is the lnpRecoveryComplete message, at the end of all previous data recovery requests. This instructs the NPAC SMS to send previously queued messages, at the next scheduled retry interval, and resume normal processing.



a. SOA establishes association with resynchronization flag on, *along with network data management (networkDataMgmt) association function set.*

b. Local SMS sends M-ACTION to start network data download. The Local SMS specifies the criteria.

c. NPAC SMS responds to M-ACTION with updates.

d. SOA sends M-ACTION to recovery notifications by time range.

e. NPAC SMS responds to M-ACTION with notification updates.

f. SOA sends M-ACTION to set resynchronization flag off.

g. NPAC SMS replies with to the M-ACTION.

h. Normal processing resumes and any activity that the NPAC SMS had queued up during the recovery period will now be sent, *at the next scheduled retry interval*.

GDMO

Action Definitions

1.0 LNP Download Action (existing text is shown below, new text is shown in *larger print italics*):

```
lnpDownloadBehavior BEHAVIOUR
    DEFINED AS !
        Preconditions: This action is issued from an lnpSubscriptions
        or an lnpNetwork object and all objects to be downloaded
        are specified in the action request.

        Postconditions: After this action has been executed by the Local
        SMS or SOA specifying which objects to download, the NPAC SMS will
        determine which objects satisfy the download request and return
        them in the download action reply. Creation, deletion, and
        modification information will be included in the reply.  All data
        for objects that have been modified is downloaded not just the
        information that was modified.

        Data to be downloaded can be specified by a time range of last
        modification/creation or by other criteria.  Time range requests
        will be limited to a tunable range specified in the NPAC SMS.
        All data modified/created in the download time period, regardless
        of the amount of data, will be downloaded.  For download requests
        whether or
        not specifying a time range, the amount of data downloaded will be
        limited to a tunable amount as specified in the NPAC SMS.

        Criteria for a subscription download is a time range or a TN or
        TN range.  For TN ranges the stop TN in the range must be greater
        than the start TN in the range.

        Criteria for a network data download is a time range, service
        provider id or all service providers, an npa-nxx range or all
        npa-nxx data, an LRN range or all LRN data, or all network data.

        If a download requests fails in the NPAC SMS, the failure reason
        will be returned in the reply. The following errors can be returned
        in the lnpDownloadReply:

        criteria-too-large - Too many records are being returned.  This is
        determined by the MAXIMUM NUMBER DOWNLOAD RECORDS tunable on the
        NPAC SMS.

        time-range-invalid - The time range given exceeds the MAXIMUM
        DOWNLOAD DURATION tubable on the NPAC SMS.

        no-data-selected - No criteria selected in request.

        failed - Failed for other reasons.
```

For all download requests in this scenario, the Local SMS or SOA should behave as follows in response to the possible download M-ACTION response from the NPAC SMS:

Success – process the data received from the NPAC SMS, continue processing.

No-data-selected – no data was found, continue processing.

Criteria-too-large (using the Maximum Number of Download Records tunable) – break up the request into a smaller time range and re-issue the request to the NPAC SMS (only applies to SV requests).
OR
Criteria-too-large (using the Maximum Number of Download Notifications tunable) – break up the request into a smaller time range and re-issue the request to the NPAC SMS (only applies to notification requests).

Time-range-invalid (using the Maximum Download Duration tunable) – break up the request into shorter time ranges and re-issue the request to the NPAC SMS.

~~*Failed – go into retry mode. Re-issue the request two additional times with an "x" minute delay between requests. If a failed response is received for the third retry request, abort the association and re-start the recovery process. Note: It is assumed that the Local SMS or SOA would use the same value that the NPAC SMS uses for retry interval.*~~

Failed – go into retry mode. Re-issue the request ~~two~~ a configurable number of additional ~~times~~ retry attempts with an "x" ~~minute~~ amount of delay between requests ("x" is based on a configurable amount of time after receiving the failure for each request). If a failed response is received for the ~~third~~ final retry request, abort the association and re-start the recovery process. Note: It is ~~assumed~~ recommended that the Local SMS ~~would~~ use the same value that the NPAC SMS uses for retry interval. It is also recommended that the Local SMS use a value of at least two (2) for configurable number of additional retry attempts.

For activities that specify "continue processing", the Local SMS or SOA should send the NPAC SMS, either the next lnpDownload Action for a different type of data, or an lnpRecoveryComplete request, depending on where the response appears in the flow.

SOAs can ~~only~~ use the lnpDownload action to recover network data and notification data.

Local SMSs can use the lnpDownload Action to recover network data, subscription version data, and notification data.

~~*The SOA or LSMS is capable of recovering data based on the specific association function for network data download (SOA) and network and subscription data download (LSMS), as specified in the initial association request to the NPAC SMS.*~~

The SOA or LSMS is capable of recovering data based on the association functions. The SOA recovers network data and notification data using the network data management association function (networkDataMgmt). The LSMS recovers network data and subscription data using the data download association function (dataDownload), and recovers notification data using the network data management association function (networkDataMgmt).

```
!;
```

15.0 Notification Recovery Action (existing text is shown below, new text is shown in *larger print italics*):

lnpNotificationRecoveryBehavior BEHAVIOUR
DEFINED AS !
Preconditions: This action is issued from an lnpNPAC-SMS object from a SOA or LSMS that specified the recovery mode flag in the access control as true at association establishment.

Postconditions: After this action has been executed by the SOA or LSMS specifying recovery, the NPAC SMS will forward the notifications that occurred in the time range specified for the requesting system (SOA or LSMS) for the primary or associated SPID specified in the access control. Notifications are forwarded in the action reply.

Notifications to be recovered are requested by time range. Time range requests will be limited to a tunable range specified in the NPAC SMS. ~~All data in the download time period, regardless of the amount of data, will be returned.~~ *For download requests, the amount of data downloaded will be limited to a tunable amount as specified in the NPAC SMS. The tunable used to determine the maximum is "MaxNotificationRecovery" which defaults to 2000 notifications.*

The recovery of the SOA and LSMS notifications are independent requests. Notifications can be recovered until they are purged from the database. The tunable used to determine when to purge the notifications is "Notify Log Retention Period" which defaults to 90 days.

For all download requests in this scenario, the Local SMS or SOA should behave as follows in response to the possible download M-ACTION response from the NPAC SMS:

Success – process the data received from the NPAC SMS, continue processing.

No-data-selected – no data was found, continue processing.

Criteria-too-large (using the MaxNotificationRecovery tunable) – break up the request into a smaller time range and re-issue the request to the NPAC SMS.

Time-range-invalid (using the Maximum Download Duration tunable) – break up the request into shorter time ranges and re-issue the request to the NPAC SMS.

~~*Failed – go into retry mode. Re-issue the request two additional times with an "x" minute delay between requests. If a failed response is received for the third retry request, abort the association and re-start the recovery process.*~~

Failed – go into retry mode. Re-issue the request ~~two~~ a configurable number of additional ~~times~~ retry attempts with an "x" ~~minute~~ amount of delay between requests ("x" is based on a configurable amount of time after receiving the failure for each request). If a failed response is received for the ~~third~~ final retry request, abort the association and re-start the recovery process. Note: It is ~~assumed~~ recommended that the Local SMS ~~would~~ use the same value that the NPAC SMS uses for retry interval. It is also recommended that the Local SMS

use a value of at least two (2) for configurable number of additional retry attempts.

For activities that specify "continue processing", the Local SMS or SOA should send the NPAC SMS, either the next lnpDownload Action for a different type of data, or an lnpRecoveryComplete request, depending on where the response appears in the flow.

~~*The SOA or LSMS is capable of recovering data based on the specific association function for network data download (SOA) and network and subscription data download (LSMS), as specified in the initial association request to the NPAC SMS.*~~

The SOA or LSMS is capable of recovering data based on the association functions. The SOA recovers network data and notification data using the network data management association function (networkDataMgmt). The LSMS recovers network data and subscription data using the data download association function (dataDownload), and recovers notification data using the network data management association function (networkDataMgmt).

!;