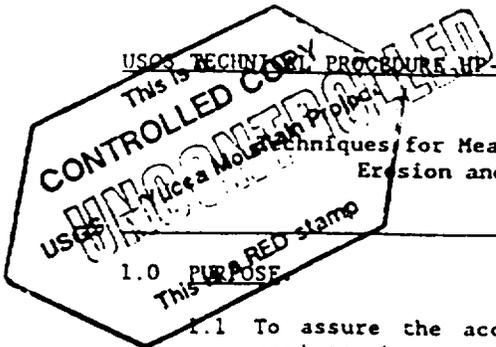


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1.0 PURPOSE

Techniques for Measuring Severe Stream-Channel or Hillslope Erosion and (or) Resultant Sediment Deposits

1.1 To assure the accuracy, validity, and applicability of the methods used to document severe and sudden erosion of stream channels and hillslopes by runoff from intense storms and (or) the resultant sediment deposition from this erosive activity, this procedure provides a guide for USGS personnel and contractors to perform the described activity. From this procedure, the Department of Energy (DOE) and the Nuclear Regulatory Commission (NRC) can evaluate these activities for meeting requirements of the NNWSI Project, and competent, trained personnel can reproduce the work.

1.2 This procedure describes the components of the work, the principles of the methods used, and their limits. It also describes the detailed methods to be used for calibration, operation and performance verification of any equipment. In addition, it defines the requirements for data acceptance, documentation, and control; and it provides a means of data traceability.

2.0 SCOPE OF COMPLIANCE.

2.1 This procedure applies to all USGS personnel and their contractors who may perform work referred to in Para. 1.1, or use data obtained from this procedure if it is deemed to potentially affect public health and safety as related to a nuclear waste repository.

2.2 All data derived from this procedure that are presented to support licensing of the NNWSI Project repository, and any equipment calibrations or recalibrations that may be required shall be in accordance with this technical procedure. Variations are allowed only if and when this procedure is formally revised, or otherwise modified, as described in Section 8.

3.0 PERSONNEL RESPONSIBILITIES. The Principal Investigator (PI) is responsible for assuring full compliance with this procedure. Per QMP-2.02 and QMP-2.03, the PI shall require that all personnel assigned to work under this procedure shall have the necessary technical training, experience, and personal skills, to adequately perform this procedure; and they shall have a working knowledge of the USGS QA Manual. Responsibilities of others including the reviewer(s), contributing investigators, Branch/NHP Chief, QA Office and the Chief, Branch of NNWSI are as described in Para. 4.3, QMP-5.01.

4.0 DETAILED PROCEDURE. Intense storms cause land-surface runoff that can promote severe erosion of hillslopes and stream channels. This erosion mobilizes sediment and debris that can be hazardous and troublesome to the

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mobilizes sediment and debris that can be hazardous and troublesome to the transport, handling and storage of nuclear wastes.

4.1 Objective: To document the occurrences and magnitudes of severe erosion caused by runoff from intensive storms, and (or) the sediment deposits that result from this erosive activity.

4.2 Methods Used: Documentation of (1) catastrophic erosion that results in debris-charged surface runoff, (2) the hazardous movements of the debris after mobilization, and (3) the deposition of the debris, are not standardized, hydrogeologic-measurement procedures. These types of events are not routinely documented, and documentation techniques are usually custom-designed by individual investigators to suit the unique scientific objectives of each specific investigation. Techniques are also tailored to address the unique hydrologic characteristics of the individual events being studied. As a result, documentation of these events for the NNWSI will involve an applied-research approach that may be somewhat unique to the Yucca Mountain study area. The following proposed methods constitute a preliminary strategy to collect badly needed information pertaining to the hazardous movement of fluviially-transported debris, if and when it occurs, during the assessment of flood and debris hazards at and near Yucca Mountain. During the evolution of this proposed strategy, various methods will be tried and tested; those found acceptable may evolve into a more routine methodology that can be standardized into formal techniques. Until some level of experience evolves, the following general methods will be tried, tested, and documented to provide the essential hydrologic data, as currently perceived, that are necessary to better understand the physical processes involved.

This preliminary strategy and suggested investigative methods are, as follows:

4.2.1 After a severe storm, areas of known intensive precipitation and (or) severe runoff should be reconnoitered to determine if erosion of a significantly severe magnitude has occurred to warrant documentation. Assessment of the degree of severity and hydrologic significance of erosion, sediment movement, and debris deposition involves on-site field decisions entrusted to the scientific judgement of the field investigator. Reconnaissance, although usually performed by automobile and on foot, may also include an airlift over the area of concern to attain added perspective on the areal extent and intensity of erosive activity.

4.2.2 Sites of significantly severe erosion that are discovered during the reconnaissance will be located on appropriate topographic maps and (or) aerial photographs. The selection of map scale is entrusted to the judgement of the field investigator, and will depend on the scale and intensity of the erosion and the nature of the reconnaissance, and the availability of topographic maps at the needed or desirable scale.

4.2.3 Erosion scars, flood-flow paths, and (or) resultant sediment (debris) deposits may be further documented, if deemed necessary and

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appropriate by the field investigator, by photographing all or parts of the scars and deposits. This photography can be a major source of basic data. Photographs can be black and white, color, or an appropriate mix, depending on the judgement of the field investigator. Other remote sensing products that might become available (satellite imagery, etc.) can also be utilized to further document the locations and characteristics of erosion scars and sediment deposits, if they are deemed appropriate and useful to the investigation by the project and (or) field investigator.

4.2.4 During, or following, the field reconnaissance, physical measurements of the sizes of select scars and sediment deposits and select clasts of transported debris may be made. Measurements may be made using graduated tapes, rules, rods, taglines, or plane surveying techniques. A determination of the degree of accuracy to be employed in making measurements will be entrusted to the field investigator; this latitude in judgement is allowed because the sensitivity and significance of the measurement techniques must be judged on a case-by-case basis by the investigator to determine the scale of measurements needed to adequately characterize and document the hydrologic processes involved. The measurements, or estimates, may be used to determine the volumes of material eroded and (or) deposited, and the general size characteristics of the debris transported.

4.2.5 The character of the land surface where erosion, transport, and deposition occurred may be described either qualitatively, quantitatively, or both. The description may include some, or all, of the following: geologic character of the land surface at the erosion site, land-surface slope, depth to bedrock, bedrock lithology, slope of the flow path, size and character of the drainage catchment, and character and slope of the depositional area. Slopes can be scaled from appropriate topographic maps and (or) measured with a compass or hand level in the field. Depths to bedrock can be measured with devices cited in Para. 4.2.4. As described above, measurement scales and accuracies will be selected by the field investigator to correspond with the character of the investigation at each specific site and for each event.

4.3 Alternative Method(s) Considered: None. All currently known approaches and methods were included under 4.2.

4.4 Materials/Equipment Required:

- o Copy of this procedure
- o Linear measurement device for measuring distances to scale judged appropriate by field investigator
- o Compass or hand level
- o Topographic maps and (or) aerial photographs
- o Note paper for recording data

4.5 Assumptions Affecting the Procedure: None.

4.6 Data Information: Locations and sketches on topographic maps, photographs, measurement data on paper sheets.

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4.6.1 Quantitative/Qualitative Criteria - We can't define these techniques more precisely until we accumulate adequate experience in addition to better definition of techniques. To add more rigid guidelines will unacceptably restrain our need to experiment during early stages of this investigation.

4.7 Limitations: The limitations of this procedure include the identifiability of the presence and limits of erosion scars or sediment deposits, the scale and details of available topographic maps, the physical accessibility to areas affected, and the applicability of the suggested methods.

4.8 Other: None.

5.0 CALIBRATION REQUIREMENTS. Calibration is not required as a part of this technical procedure. When calibrations are required, all instruments and methods when applicable, will be calibrated in compliance with the Instrument Calibration Procedure (NNWSI-USGS-QMP-12.01) prior to obtaining data that will be cited to support licensing the NNWSI Project.

6.0 IDENTIFICATION AND CONTROL OF SAMPLES. Samples will not be collected as part of this procedure.

7.0 QUALITY ASSURANCE RECORDS. All information collected and recorded under this procedure that is to be used in support of the NNWSI Project licensing process is required to be a part of the official USGS record. Input needed to process the information as a record includes: title or description, subject, originator, date of the document, and whether it is an original, a revision or an addendum.

Specific items from this procedure that will constitute a record are topographic maps, photographs (aerial and surface), and notebooks or note paper.

7.1 Notebooks or other organized documentation will be prepared as appropriate by the PI or a contributing investigator to record data from this procedure and shall include any information considered by the originator to be pertinent. When data are kept in loose-leaf form, each page will be numbered consecutively and chronologically. All documents will be signed or initialed and dated by the investigator on a daily basis when entries are made. Any revisions will be lined out, initialed, and dated.

7.2 All data collected and the applicability of methods used in this procedure will be reviewed and cosigned by a peer or supervisor of the investigator knowledgeable with the objectives of this procedure in accordance with NNWSI-USGS-QMP-6.01, Para. 4.2.2; and as such are acknowledged by both the investigator and the reviewer to be acceptable and meaningful data that meet appropriate quantitative and qualitative acceptance criteria. Unacceptable data shall be identified appropriate to the form of the data.

8.0 MODIFICATIONS. When field modifications become necessary, per Para. 4.8, QMP-5.01, the PI shall fully document the changes, submit the documentation

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for the same review signature and distribution process as for the original procedure, and indicate whether the change should result in a subsequent revision to the technical procedure. The documentation will be reviewed within 30 days.

9.0 REFERENCES CITED.

None.

10.0 ATTACHMENTS. There are no attachments included with this technical procedure.

11.0 APPROVAL. This technical procedure shall become effective upon its approval as noted by completion of all the following signatures and dates.

Patrick A. Glancy May 30, 1988
Prepared by: Patrick A. Glancy Date

Otto Moosburner June 2, 1988
Technical Reviewer: Otto Moosburner Date

K. W. Causseaux 6/7/88
NHP QA Coordinator: K. W. Causseaux Date

K. W. Causseaux 6/7/88
for Acting NHP Chief: D. C. Gillies Date

L. R. Hayes 6/7/88
Chief, Branch of NNWSI: L. R. Hayes Date

J. R. Willmon 6/7/88
Quality Assurance: J. R. Willmon Date

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