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FROM: Frank J. Arsenault, Acting Director
Division of Safeguards, Fuel Cycle
and Environmental Research

SUBJECT: CONSEQUENCE ESTIMATION PHASE II TECHNICAL REVIEW

Phase II of the Consequence Estimation Project has the following objectives:

1. Identify state-of-the-art methodology which may be used to determine the consequences of the reference events identified in Phase I;

2. Identify modifications and additions to the existing methodology which may be required to complete the analysis of events required by this study, and;

3. Estimate the duration and cost of a program in which the methodology is acquired, developed and modified, and applied to analyze the reference events identified in Phase I.

In pursuit of these objectives first priority is to be given to the development of a program which includes the minimum methodology development or modification necessary for the general analysis of events identified in Phase I. Such a package will form the baseline scope of work proposed for execution in Phase 3 of this project. More ambitious modification or development work identified under Part 2 of the above objectives will be described separately and presented with a clear statement of its potential additional contribution to the project.

To facilitate the accomplishment of the above objectives Consequence Estimation methodology has been divided into five areas, as follows:

Nuclear Explosive Environments (less fallout)
Contaminant Source Characteristics
Environment Transport (including fallout)
Alternate Pathways (other than direct irradiation and inhalation)
Health Effects and Property Damage Criteria

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The content of these general technical areas is further defined in the enclosures.

SAI is nearing completion of Phase II and has suggested that informal peer technical reviews be initiated in each of the five areas separately.

I would like you to suggest nominees for each of the five areas. These nominees must have recognized technical credentials in the relevant area and may be either government employees or from outside the government. The method of administering the review has not been established and will likely be affected by the makeup of the group.

Please phone your suggestions to Jack Berggren at 427-4387 as soon as possible as we hope to take action by February 15.

ORIGINAL SIGNED BY:
FRANK J. ARSENAULT

Frank J. Arsenault, Acting Director
Division of Safeguards, Fuel Cycle
and Environmental Research

Enclosure:
Work Scope: Nuclear Explosive Environments

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WORK SCOPE

CONTAMINANT SOURCE CHARACTERISTICS

I. Radioactivity Release Rate Analyses
   - A. Blast Induced
     1. Inventory definition-form and specific activities
     2. Liquid dispersion
        - a. Droplet sizes
        - b. Evaporation rate analysis
     3. Solid dispersion
        - a. Primary particle size specification
   - B. Thermally Induced
     1. Inventory definition
     2. Volatility data input
     3. Chemical reaction evaluation
     4. WASH-1400 and conventional safety analyses methodology application

II. Radioactivity Transport and Deposition in Closed Systems-Computer Code Development
   - A. Aerosols
     1. Particle size distribution function
     2. Agglomeration model
     3. Gravitational settling model
     4. Inertial impaction (surface collision) model
   - B. Vapors
     1. Deposition analysis
   - C. Geometery Variations
     1. Series of chambers
        - a. Rooms
        - b. Long ducts
   - D. Flow Conditions and Leak Rates
     1. Forced convection
     2. Natural convection

III. Thermal and Heat-Transfer Analyses-Effect on Containment
   - A. Fire Effects
     1. Atmosphere heating vs. time
     2. Temperature profiles in structure
     3. Thermal loads on filter and ducts
   - B. HAW Tank Meltthrough Analysis
     1. Temperature profiles-failure time

2. Concrete penetration model
3. Soil penetration analysis
4. Groundwater interaction analysis

IV. Supporting Analyses or Data Acquisition
A. Filter performance and failure specifications
B. Metallurgical reaction data
C. Facility design detail input
D. Geology and hydrology parameter input
E. Sensitivity calculations with T & D code

WORK SCOPE

ENVIRONMENT TRANSPORT (INCLUDING FALLOUT)

NUCLEAR BURST EFFECTS

- Assess status and accuracy of available deposition models for relevant conditions (yield, topography, etc.)
  - review fallout, rainout, washout models
  - review available material on anomalous fireball rise (shock-induced torusing from structures surrounding event point)
- Review previous work on effects of built-up areas
  - wind channeling
  - sewer runoff
  - deposition on roofs and crevices

NON-NUCLEAR BURST DISPERSION

- Define criteria necessary for the evaluation of air and ground concentrations as a function of time and space after the initiation of the event (include effects due to particle size, local topography, time-dependent source terms, variety of nuclides, etc.
- Review existing models by comparing them against the criteria specified above.
- Specify in detail the effort required to modify model to comply with criteria.

SCIENCE APPLICATIONS, INC.

Work Scope

Alternate Pathways

1. Define pathways to man as appropriate for event type.

2. Survey data base availability and applicability.

3. Identify primary (early time pathway analysis requirements) vs long-term effects.

4. Identify applicable models and suggest procedures for analyzing inhalation/ ingestion pathways for early times and long-term effects.

5. Examine resuspension models for Pu and determine impact of EPA position relative to DoD decontamination efforts. Recommend a model for short-term and long-term effects via this pathway.

6. Determine the appropriate models for assessing the population dose. This would include evaluation of dosimetry models, i.e., lung, G.I.

7. Evaluate water/water-sediment pathway codes for accident situation.

8. Determine the requirements for introducing cleanup/decontamination scenarios into the pathways models and cost factors.

9. Recommend the pathways models to be used in the study.

WORK SCOPE

HEALTH EFFECTS AND PROPERTY DAMAGE CRITERIA

HEALTH EFFECTS

- Radiation: Determine sources for a consistent set of data for Dose/Exposure Conversion as a function of exposure pathway, critical organ, particle size and body solubility. Determine sources for a consistent set of data for Effect/Dose Conversion.

- Other Environments: Determine sources for consistent sets of data for Effect/Exposure Conversion. Determine source for a consistent set of data for mixed environment synergisms on health effects.

PROPERTY DAMAGE

- Review existing criteria for property disposition in the event of contamination. Determine sources from which a consistent set of such criteria may be obtained.

- Determine sources for a consistent set of criteria for property damage from environments other than radioactive contaminants, i.e., blast, thermal, EMP, etc.

WORK SCOPE

NUCLEAR EXPLOSIVE ENVIRONMENTS

1. Significant device characteristics
   - 1.1 Homemade characteristics as distinct from military weapons
   - 1.2 Impact of "spiking" weapon with cobalt, iodine, etc.
   - 1.3 Modifications resulting from device packaging and delivery mechanism
   - 1.4 Modifications due to placement within large building
   - 1.5 Lowered thermal partition

2. Scenario dependencies
   - 2.1 Specific scenario locations and effects thereof
     - 2.1.1 Metro area - street intersection
     - 2.1.2 "Paved" surface
     - 2.1.3 Residential area
     - 2.1.4 Inside large building
     - 2.1.5 Open
   - 2.2 Specific aspects
     - 2.2.1 Building protection factors for ground burst
     - 2.2.2 Threshold for very low-yield containment by building
     - 2.2.3 Blast channeling in buildings
     - 2.2.4 Multiple building effects

3. Health effects
   - 3.1 Inclusion of thermal and blast
   - 3.2 Consideration of both lethality and injury
   - 3.3 Effects variations
     - 3.3.1 Age - radiation and burns
     - 3.3.2 *In utero* irradiation
     - 3.3.3 Synergisms - radiation with burns and mechanical injury
     - 3.3.4 Glass shards and radiation

4. Other effects
   - 4.1 Property damage
     - 4.1.1 Residential
     - 4.1.2 Urban - downtown buildings
   - 4.2 EMP on civil communications

5. Uncertainties
   - 5.1 Uncertainties of source, environmental and effects parameters
   - 5.2 Impact of uncertainties on consequences