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OFFICE MEMORANDUM

TO : Ron Lohrding/Dick Beckman, C-5

DATE: August 31, 1973

FROM : Wayne C. Hanson, H-8

SUBJECT : INFORMATION NEEDS FOR VARIOUS CATEGORIES OF PARAMETERS CONCERNED WITH RISK ANALYSIS/EVALUATION OF PAST TRU WASTE DISPOSAL PRACTICES (A-414)

SYMBOL : H-8-73-180

1029
TA-54

Attached are several pages of information needs for categories of meteorological, environmental, geological and hydrological, past TRU burial practices and ecosystem description considerations which were originally outlined in Memo H8-M-73-153. These were developed by Sumner Barr, Keith Schiager, Bill Purtymun/Margaret Anne Rogers, John Warren, and me respectively.

According to our previous agreement, you will next week review these needs relative to their applicability to our evaluation of past TRU waste disposal practices. We will then proceed to (1) critique these data at a meeting of all interested parties at the OHL Building Conference Room at 0815 on 7 September 1973; (2) update and amend them into a final form; and (3) apply them initially to LASL, beginning with Waste Disposal Area G at TA-54, and then to other US waste disposal sites.

Distribute to:

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TRU WASTE DISPOSAL RISK ANALYSIS
PAST BURIAL PRACTICES INFORMATION NEEDS

1. Locate (map) and identify all individual burial sites, pits, trenches, etc.

2. For each of the above, the following is needed:

   a. What were the approximate dates of usage?
   b. What are the volumes (and weights) of wastes disposed of?
   c. What were the type(s) of waste disposed of?

      (1) The amount of combustible waste, the composition of this material, and possibly, if available, the breakdown (volume, weight, etc.) of combustibles by type
      (2) The amount of noncombustible waste, types of material, amounts of each type; e.g.,
          sludges
          filters
          equipment, building debris
          scrap metal
      (3) The possible "special" wastes disposed of, in particular, pyrophoric materials, flammable liquids, oils, etc., potentially hazardous chemicals disposed of in bulk quantities, etc. Identify all especially hazardous wastes.
      (4) The primary chemical contaminants that are present in the waste matricies.

   d. What are the radioactive contaminants present?

      (1) What transuranics are present, and in what amounts (wt., curies, etc.). In particular, identify ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{241}Am.
      (2) What other radioactive isotopes were disposed of by burial at the same location, both fission product and induced radioactivities? Identify and give amounts as available.

   e. How were these wastes packaged when buried?

      (1) Identify the different types of basic container - and waste type contained.
      (2) Identify any inner "liner" material used, e.g., plastic, PVC bag, etc.
      (3) How was the primary package sealed - how was any inner packaging sealed?

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f. Describe the methods of burial

(1) Was waste "dumped" or stacked into burial pit?
(2) Was waste crushed and compacted in this burial operation?
(3) What was pit depth?
(4) What was original thickness of earth cover on pit?
(5) What is the condition of this cover today, i.e., intact, settled, partially eroded, planted, etc?

3. What, if any, incidents have occurred at the burial ground involving the contaminated wastes (e.g., fires, escape of airborne contamination, water problems, etc.)? Describe cause and consequences of each such occurrence during waste burial operations? at any time following burial?

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TRU WASTE DISPOSAL RISK ANALYSIS

METEOROLOGICAL INFORMATION NEEDS

Hazard	Relevant Met Parameter	Useful Form of Data
1. Flood	Heavy rains*	Hourly rain > .5", 1", etc. Daily rain > 1", 2", 3", . . . 5" . . .
2. Fire	Drought	Distribution of No. of days without precipitation
3. Catastrophic Wind Removal	Wind ≥ 90 mph	Freq. of occurr. of high wind, tornadoes, hurricanes
4 Long-term Wind transport	Wind direction /speed Atmos. stability Atmos. Pressure	Wind roses (joint dir/speed distrib.) as function of stability (vert. temp. gradient) or some similar measure e.g. turbulance level, time of day

Brief Discussion

1. It would seem that standing water in an open pit deep enough to float some barrels would invite leakage, breaches, etc. therefore be a useful criterion for a hazard level. To obtain this situation depends on the total amount of rain expected, and; since there will be a net transport out of the hole thru the soil, it will depend somewhat on rate. For example, 1 inch in an hour may yield the same water levels as 3 inches in a day.

Another hazard is the leaching of waste materials into the soil. This probably depends more on consistency of precipitation over long periods than the sudden downburst. Hence, we need the distribution of hourly and daily rainfall rates for each waste disposal site.

2. Although it may be a minor factor in the propagation of a fire in a pit, the moisture in the soil and waste material is a factor. Also, it may have some influence on the spreading of fire to nearby vegetation. A distribution of periods (no. of days) without precipitation may be useful.

3. An unlikely but potentially severe hazard exists in the removal of waste material from open pits by extremely strong winds such as tornadoes and/or hurricanes. We should have estimates of the probability of occurrence and the intensity of these vortices. Both parameters are very dependent on geography.

4. The long term release of material from open or closed burial dumps may be affected by soil resuspension, diffusion of gaseous products through the soil or the action of vegetative cover. Its subsequent transport and dispersion depends on the low level wind and turbulence fields. One useful method of approaching the estimation of these fields is through wind roses stratified by some measure of turbulence intensity. The most common variable used to describe the low level turbulence is the vertical temperature gradient.

Finally, if the diffusion of gaseous products thru soil proves to be important, the emanation rate of these products will depend on atmospheric pressure, soil moisture (i.e. recent rainfalls).

The quantities described above tend to be expressed in terms of compiled statistical summary parameters. It should be expected with a new and complex problem such as this one that as the models develop, new parameters may be desired from the data. Hence it's desirable in some ways to have raw data. The trade-off comes in the time required to process raw data. We may want to request both raw and compiled data for some studies of various sites.

TRU WASTE DISPOSAL RISK ANALYSIS

GEOLOGY AND HYDROLOGY INFORMATION NEEDS

A. Regional Geology
   1. Stratigraphy
   2. Structure
   3. Seismicity

B. Regional Hydrology
   1. Surface Water
      a. Drainage Basins
      b. Discharge Records
      c. Quality of Water
      d. Use
         (1) Municipal
         (2) Industrial
         (3) Domestic
   2. Ground Water
      a. Occurance of Water
         (1) Artesian Systems
         (2) Water Table Systems
         (3) Recharge, movement and discharge
         (4) Artesian or Water Table trends
      b. Aquifer Characteristics
         (1) Coefficient of Transmissibility
         (2) Coefficient of permeability
         (3) Rates of movements
         (4) Yields
         (5) Specific Capacity
      c. Quality of water
      d. Use
         (1) Municipal
         (2) Industrial
         (3) Domestic

C. Site Geology
   1. Stratigraphy
      a. Soil
      b. Geologic Units
   2. Structure
      a. Joints or Fractures
      b. Faults

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D. Site Hydrology.
   1. Surface Water
      a. Drainage Basins
      b. Discharge Records
      c. Quality of water
      d. Use
   2. Ground Water
      a. Occurance of water
         (1) Artesian Systems
         (2) Water Table systems
         (3)Recharge, movement, and discharge
         (4) Artesian or water table trends
      b. Aquifer Characteristics
         (1) Coefficient of Transmissibility
         (2) Coefficient of Permeability
         (3) Rates of movement
         (4) Yields
         (5) Specific Capacities
      c. Quality of Water
      d. Use
   3. Zone of Areation
      a. Soil or Rock type
         (1) Porosity
         (2) Effective Porosity
         (3) Specific Yield
         (4) Specific Retention
         (5) Pore size distribution
         (6) Permeability
      b. Occurance of Soil Moisture
         (1) Distribution of soil moisture
         (2) Rates of infiltration
         (3) Evapotransparation Rates
E. Miscellaneous Data - maybe covered above
   1. Well and test hole inventory
   2. Geologic logs
   3. Aquifer tests

PU WASTE DISPOSAL RISK ANALYSIS -

ENVIRONMENTAL

TYPES OF INFORMATION NEEDED

To determine particle sizes and relative solubilities of aersols that might be released to the atmosphere by:

A. Fires

1. The most obvious information to seek is data on aerosols released by any past fires in similar materials.
2. The probability of a slow, smoldering fire vs. a hot, crackling fire; the probable combustion temperatures in each case. (The temperature of combustion has a strong influence on both particle size and solubility.)
3. Quantities of other combustibles, particularly oil, that might be involved per unit mass or unit activity of plutonium. (This helps to determine aerosol mixtures available for attachment of plutonium oxides.)
4. Combustion rates - activity or mass of Pu per unit time; probable average and potential extremes. (This is needed for calculating initial and subsequent concentrations in the smoke plume; also the buoyancy of the plume.)
5. Total burning time before quenching - typical and maximum response and firefighting times. (Needed for estimating total release.)

B. Resuspension from contaminated ground surface

1. The most likely source of contamination on the ground is from dried liquids, e.g. as at Rocky Flats. Therefore, the following information is relevant:
   a. Past history of any spillage on ground surface - quantities and areas involved.
   b. Types of original solvents - aqueous, aromatic, oils, etc.
   c. Pu concentrations in solution or suspension
   d. Was all Pu in solution or was some suspended and, if so, how much?
   e. If suspended, what were the original particle sizes?

2. The probability of resuspension depends not only upon the nature of the contaminant but also upon the nature of the surface. Wherever contamination of ground surfaces is a possibility, we should try to obtain the following data:
   a. type of surface soil, i.e. sandy, clay, humus, etc.
   b. typical types and densities of vegetation cover, e.g. vegetation surface area per unit area of ground, number of plants per unit area, etc. How does the vegetation cover vary with seasons?
   c. Precipitation records, i.e. seasonal distributions of rain and snow. Also, evaporation rates and variability of soil moisture content.

C. Transport equations require the usual kinds of meteorological data:
   1. Wind roses - seasonal
      - day vs. night
      - stable vs. unstable lapse rates
   2. Frequencies of inversions
   3. Frequencies and predominant directions of exceptionally high winds

TRU SOLID WASTE DISPOSAL RISK ANALYSIS –

ECOSYSTEM DESCRIPTION INFORMATION NEEDS

I. Lithosphere
   A. Geology and topography of the area (special reports - SCS, BLM)
      1. To determine boundaries of consideration
      2. Possible resuspension considerations
   B. Mineral resources
      1. Possible future extractions
      2. Value judg, ments
   C. Natural background radiation
      1. Indications of other radioactive materials
      2. Added increments of radiation exposure of native organisms
   D. Land ownership in general area
      1. Potential management problems
      2. Possible buffer zones
      3. Alternative waste disposal sites
   E. Soils
      1. Exchange capacities
      2. Resuspension considerations
      3. Soils/plant relationships

II. Atmosphere
   A. Precipitation
      1. Seasonal distribution, amounts, form
   B. General wind patterns
      1. Wind roses, inversions, flows
   C. Unusual events

III. Hydrosphere
   A. Geological considerations
      1. Porosity, leached zones, fractures
   B. Aquifers
      1. Transmissivity (flow through vertical cross section)
      2. Depth
   C. Chemical composition of waters
   D. Surface waters
      1. Discharge rates
      2. Receptors
   E. Water usage
      1. Dams, reservoirs, springs, wells within immediate area

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IV. Biosphere
- A. Human Population
  - 1. Composition and distribution in various directions
  - 2. Related to surface waters
- B. Agricultural crops
  - 1. Seasonality
  - 2. Markets
  - 3. Economic importance
- C. Domestic livestock
  - 1. Numbers and distribution
  - 2. Feeding practices
  - 3. Economic importance
  - 4. Grazing allotments in surrounding area
- D. Native vegetation
  - 1. Major vegetation types, species, and distributions
    - a. Climax, subclimax, succession on disturbed areas
  - 2. Ecological aspects of vegetation
    - a. Food base for terrestrial wildlife and domestic livestock
    - b. Shelter (implications of removal)
    - c. Modification of microclimate
    - d. Manipulation by agricultural and other agencies
      - (1) Altered plant succession
      - (2) Introduced species
      - (3) Current vegetative inventory
      - (4) Current radionuclide concentrations in vegetation
- E. Wildlife resources
  - 1. Big game animals
    - a. State and Federal management policies
    - b. Populations and distributions
    - c. Harvest information
      - (1) Subsistence hunting populations
  - 2. Small game animals
    - a. Mammals
      - (1) Management policies
      - (2) Populations and distributions
    - b. Upland game birds
      - (1) Management policies
      - (2) Populations and distributions
  - 3. Migratory waterfowl and shorebirds
    - a. Management policies
    - b. Populations and distributions
  - 4. Non-game animals

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a. Mammals
b. Birds
c. Reptiles
d. Amphibians

5. Rare or endangered species

F. Radiation ecology studies reports

G. Biological monitoring programs reports

H. Waste disposal practices

1. Dates of waste disposal pit excavations and finished depths
2. Construction mode
   a. Pits
   b. Cribs
   c. Underground tanks
3. Type, amount, and physical form of radioactive materials buried
4. Depth of fill over material
5. Date the pits were finally covered
6. Unusual incidents of container failures, fires, or other releases of radioactive materials