

INTERIM REPORT

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NRC Research and Technical
Assistance Report

INTERIM REPORT

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MONTHLY PROGRESS REPORT FOR JUNE 1980

TECHNOLOGY AND COSTS OF TERMINATION SURVEYS ASSOCIATED WITH DECOMMISSIONING OF NUCLEAR FACILITIES (189 No. A-9042)

PRINCIPAL SCIENTISTS: H. W. Dickson and C. F. Holoway

Objectives:

The technical objective of this project is to evaluate the technology and cost of conducting termination surveys at six different types of nuclear sites at three different levels of residual radioactivity. Major items for cost estimation include land surveying, radiological surveying, soil sampling, laboratory analysis, data analysis and report preparation. The anticipated sites requiring this evaluation include a representative power reactor, a fuel fabrication plant, an uranium conversion facility, a spent fuel storage site, a fuel reprocessing plant, and a non-fuel cycle facility.

Major Accomplishments:

Material has been drafted this month concerning the radiological survey techniques and costs for four types of nuclear facilities: a mixed oxide (MOX) fuel fabrication facility, a fuel reprocessing site, a spent fuel storage site, and an uranium conversion facility. The basic references for generic site parameters were given in a previous monthly progress report (ORNL/HASRD-83) for the first three of these facilities. The preliminary reference (USDOE 78) chosen for generic site parameters of an uranium conversion facility describes a site currently undergoing radiological assessment and decommissioning.

The MOX fuel fabrication facility is assumed to be located on a 4.7 km² site with a moderate-sized river running by one corner of the site. The MOX plant itself is located near the center of the site in a 12000 m² fenced area. The MOX plant is contained in a two story structure of 2400 m². Also in the MOX plant area are a cooling tower, sewage lagoons and an electrical substation. The only decommissioning mode considered is immediate decontamination for unrestricted release and two possibilities are considered:

- (1) The MOX plant has been successfully decontaminated and remains standing.
- (2) The MOX plant was demolished and removed as part of decontamination efforts.

There is a decidedly greater survey effort required for the first alternative.

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The critical radionuclides for the MOX site have been reaffirmed to be ^{239}Pu , ^{239}Pu , ^{240}Pu , ^{241}Pu and ^{241}Am . Calculations of the residual radioactivity levels of these nuclides to produce doses of 1×10^{-5} , 5×10^{-5} , and 2.5×10^{-4} Sv/y (1, 5 and 25 mrem/y) are being performed.

The generic fuel reprocessing site consists of a fenced area of 0.12 km^2 on a 4.7 km^2 site. The facilities on the site include a process building, a waste solidification plant, a fuel receiving and storage station, liquid waste storage facilities and various auxiliary facilities. The significant radionuclides for this site include ^{90}Sr , ^{129}I , ^{137}Cs , ^{147}Pm , ^{154}Eu , ^{238}Pu , ^{239}Pu , ^{240}Pu , ^{241}Am , and ^{244}Cm . Residual levels in soil for several of these nuclides must be limited to $3.7 \times 10^{-5} \text{ Bq/g}$ ($1 \times 10^{-3} \text{ pCi/g}$) or less if the most restrictive dose limit of $1 \times 10^{-5} \text{ Sv/y}$ is used. Calculations for all nuclides at the three proposed levels are being done.

The generic spent fuel storage site also includes a 4.7 km^2 area with a fenced area of 0.1 km^2 . Major facilities include a warehouse, a fuel storage station, water treatment facilities, an evaporation pond, a maintenance building, a steam plant and an administration building. The critical radionuclides have not been positively identified but are probably similar to the ones for a reference reactor site, namely ^{60}Co , ^{90}Sr , ^{134}Cs , and ^{137}Cs .

The generic uranium conversion site (USDOE 78) has an area of 2.8 km^2 and includes an uranium conversion plant with several support buildings. The particular site chosen was used for the conversion of uranium oxide to uranium tetrafluoride; however, a more typical conversion facility would produce uranium hexafluoride. The critical radionuclide is ^{226}Ra ; however, significant dose contributions also come from ^{238}U , ^{230}Th , and ^{210}Pb , depending on purity of feed material which came to the site.

A recent draft report (March 31, 1980) from Scientific Committee No. 1 of the National Council on Radiation Protection and Measurements (NCRP) recommends an annual *de minimus* dose level (for assessment of potential risks in populations) of $2.5 \times 10^{-4} \text{ Gy}$ (25 mrad) for whole body gamma irradiation. This dose level is associated with a lifetime mortality risk of 10^{-6} per person. If this draft report is approved by NCRP, it would replace NCRP Report No. 39 (NCRP 71) as recommended guidance on basic radiation protection criteria. The *de minimus* dose for other types of radiation would be based on the same level of risk (e.g., the annual *de minimus* dose for alpha radiation would be of the order of one to two mrad). The reason that the *de minimus* whole body gamma level differs from the ICRP Publication 26 (ICRP 76) value of $5 \times 10^{-5} \text{ Sv/y}$ (5 mrem/y) is that the NCRP is now taking advantage of a dose rate effectiveness factor (DREF) of five. This allows for the reduced effectiveness of low LET radiation at low dose rates (or low dose). More information on DREF is contained in NCRP Report No. 64 (NCRP 80).

Status of Project:

Material has been drafted on five of the six types of nuclear facilities to be considered this fiscal year. Preliminary survey plans and cost estimates are being developed for these facilities. Information is being sought regarding a generic site description for a non-fuel cycle facility.

The project is on schedule with preliminary survey cost estimates expected by the end of October 1980.

Manpower and Cost Summary:

Efforts in Man Months			Cost K\$			Additional cost to completion (est.)
June 1980	FY 1980	Total to date	June 1980	FY 1980	Total cost to date K\$	
1.5	4.5	4.5	11.4	31.2	31.2	\$50,000

REFERENCES

- USDOE 78 U.S. Department of Energy, *Radiological Survey of the E.I. DuPont De Nemours and Company, Deepwater, New Jersey*, DOE/EV 0005/8 (1978).
- NCRP 71 National Council on Radiation Protection and Measurements, *Basic Radiation Protection Criteria*, NCRP Report No. 39 (1971).
- ICRP 77 Recommendations of the International Commission on Radiological Protection, ICRP Publication 26, *Annals of the ICRP*, Vol. 1, No. 3 (1977).
- NCRP 80 National Council on Radiation Protection and Measurements, *Influence of Dose and Its Distribution in Time on Dose-Response Relationships for Low-LET Radiations*, NCRP Report No. 64 (1980).

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