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Westinghouse Hanford Company
P.O. Box 1970 Richland, WA 99352

March 21, 1994

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Ms. J. K. Erickson, Director
Environmental Remediation Division
U.S. Department of Energy
Richland Operations Office
Richland, Washington 99352

Dear Ms. Erickson:

TRANSMITTAL OF THE PROPOSAL FOR POTENTIAL SELECTED ALTERNATIVE FOR N-SPRINGS EXPEDITED RESPONSE ACTION

Attached is the requested N-Springs pump and treat proposal. The well test data is required before an off-the-shelf treatment system can be selected.

Combining this proposal with a vertical barrier located next to the Columbia River will meet the Item 6 requirements of the Hanford Federal Facility Agreement and Consent Order Change Request, M-14-92-01, dated January 8, 1993.

If you have any questions, please contact me on 372-2314, or Mr. J. K. Patterson of my staff on 376-0902.

Very truly yours,

T. M. Wintczak, Manager
Environmental Restoration Program

jjj

Attachment

RL - B. L. Foley
R. D. Freeberg
R. A. Holten
R. O. Puthoff (w/o attachment)
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K. M. Thompson

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ATTACHMENT 1
12 Total Pages

Proposal
For the Development of a Limited Scale
Pump and Treat System for Installation
at N-Springs

An approach is proposed to install a limited pump and treat system to treat primarily radioactive strontium-90 (^{90}Sr) found in groundwater in the area of the 1301-N and 1325-N cribs. The purpose of this activity is to partially fulfill elements of Milestone M-14-00. The Milestone recognizes the environmental impacts and public concern caused by the continuing migration of ^{90}Sr and tritium from the past operations of N reactor into the Columbia River. To address this problem, Milestone M-14 outlined a strategy enunciating the following goals:

* reduction of the flux of ^{90}Sr to N-Springs and the Columbia River,

* evaluation of commercially available treatment options to remediate groundwater, and

* collection of data necessary to set demonstratable strontium cleanup levels.

The Milestone reflects both EPA guidance (EPA/540-R-93-080) and the Hanford Past Practice Strategy (Thompson, 1991). This proposal specifically addresses only the second and third goals, the first being previously addressed by others (DOE/RL-93-23, ASI-1994).

BACKGROUND

Groundwater flows toward the northwest beneath the 1301-N Liquid Waste Disposal Facility (LWDF), carrying ^{90}Sr and tritium to the Columbia River at N-Springs. Groundwater monitoring wells are present at the site (Figure 1). They vary in construction, but most are completed at the top of the unconfined aquifer.

Tritium moves unimpeded with groundwater flow. It is present beneath the 1325-N and 1301-N cribs, and apparently has also migrated toward the north and east (figure 2). Since the 1325-N crib was taken out of service in 1991, the center of the tritium plume has moved downgradient toward the river. Groundwater and the tritium plume have been estimated to flow at 1 to 2 ft/d (Hartman 1994). Unfortunately, commercial technology to treat tritium is not currently available.

The areal distribution of ^{90}Sr is illustrated in Figure 3. The major plume is associated with the 1301-N LWDF. A smaller plume is observed at the 1325-N LWDF. Because ^{90}Sr sorbs to sediment grains, the plumes are relatively immobile in groundwater (Hartman 1994). The movement of strontium is chemically retarded and has been estimated at 3 to 6 feet per year. ^{90}Sr is observed in N-Springs and in river shore wells at concentrations in the thousands of pCi/L (Hartman and Lindsey, 1993).

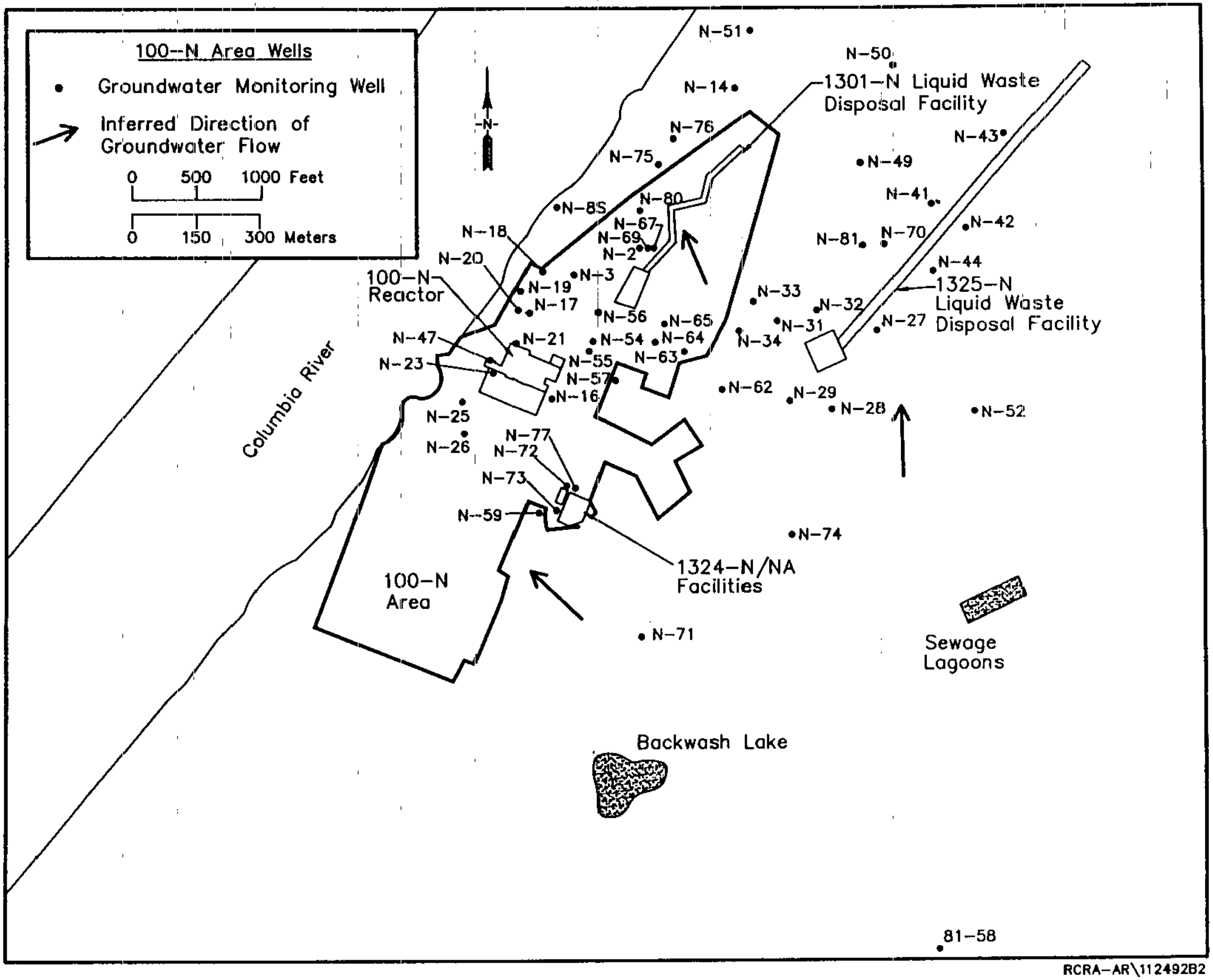

Figure 1. 100-N Area Wells.

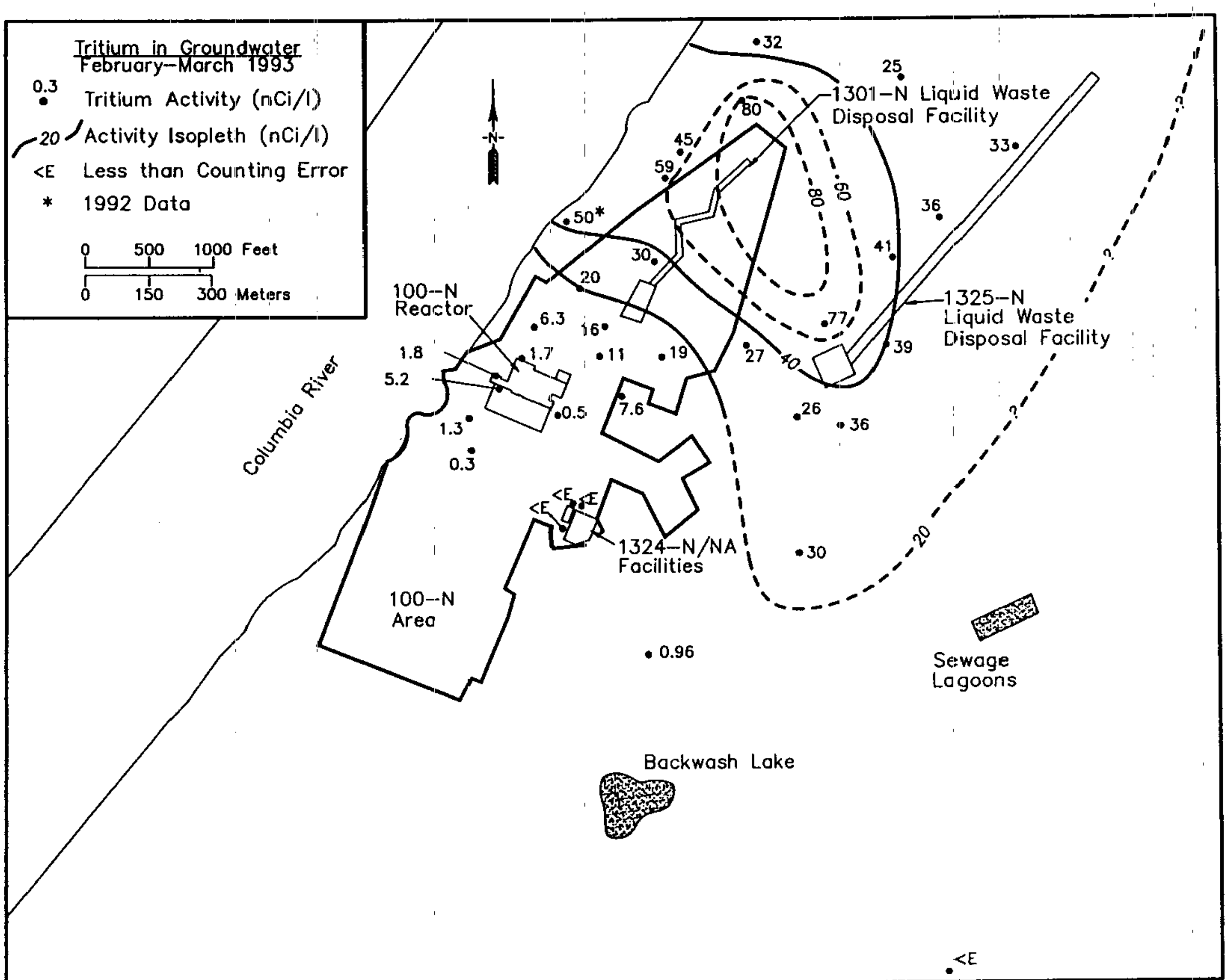

Figure 2. Tritium in Groundwater.

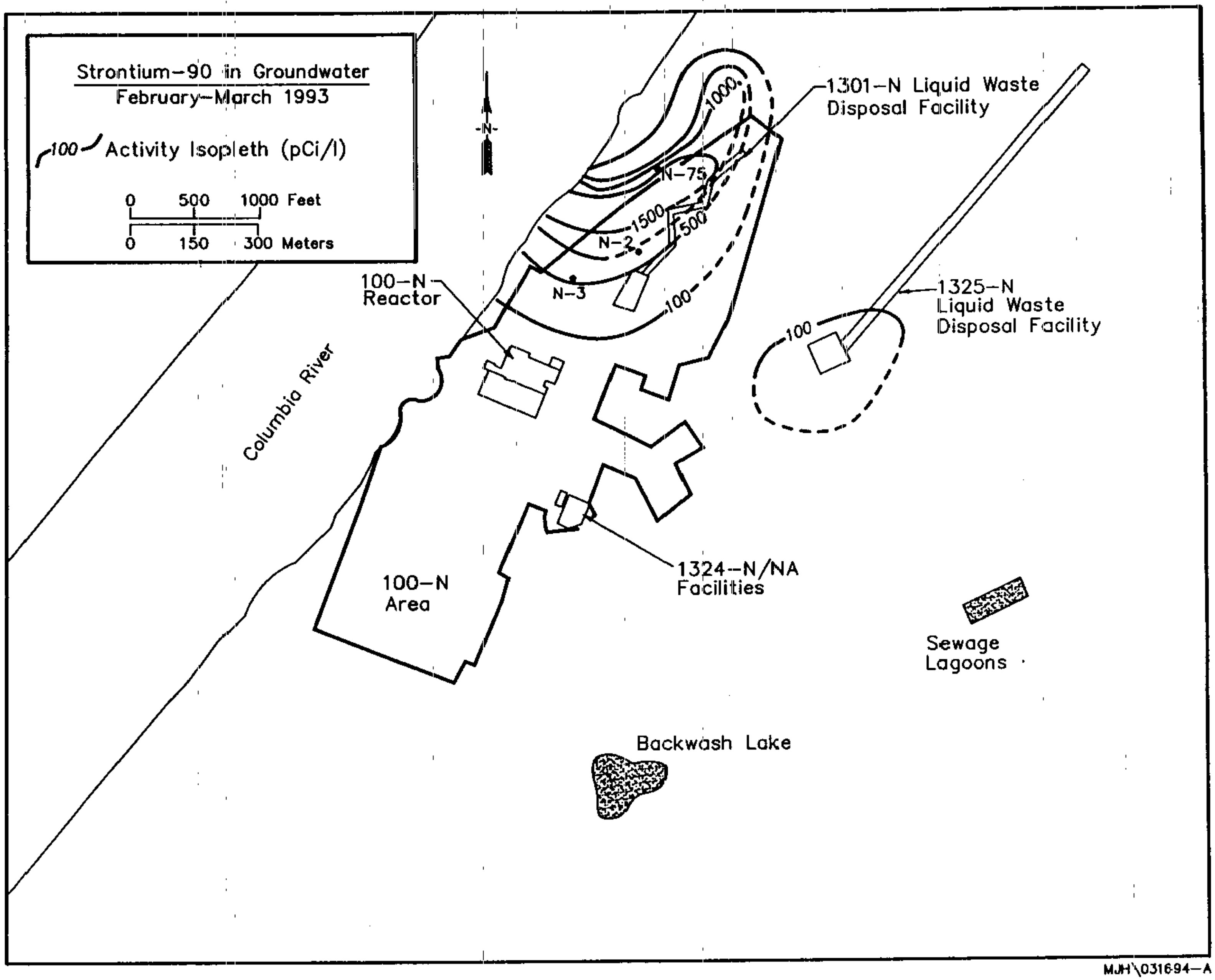

Figure 3. Strontium-90 in Groundwater.

Wells completed at the base of the unconfined aquifer and one well completed below the shallowest confining unit show no detectable ^{90}Sr (Hartman and Lindsey, 1993). The ^{90}Sr contamination appears to be limited to the vadose zone and the top 20 ft of the aquifer. This is believed to be due to the strong sorption of ^{90}Sr to the aquifer sediments. Flux of strontium to the river is believed to be naturally declining in proportion to the declining hydraulic gradient observed in the area.

CONSTRAINTS

In keeping with the stated goals, implementing direction established a number of constraints for guidance that are collected and presented here for the purpose of clarity.

- o Only existing wells are to be considered for pumping and/or monitoring.
- o Withdraw water at a rate that has minimum hydraulic impact on the system.
- o Primarily evaluate "off the shelf" technology but make allowances for the evaluation of innovative or emerging technologies.
- o Any proposed system should not create a worsening problem.
- o Consider river discharge, use of existing cribs (1325 N), existing wells, etc., if they do not worsen the contamination problem or add to the off site dose.

These constraints re-affirm the stated goals of Milestone M-14-00 to move aggressively to conduct field tests of "off the shelf" treatment technology in a cost effective manner. The testing of pump and treat effectiveness to hydraulically control the movement of the dissolved contaminants and to permanently remediate the aquifer are outside the scope of this effort.

PROPOSAL

To rapidly implement a pump and treat field testing program, WHC proposes a staged effort consisting of the tasks shown in Table 1. Major work elements defining each task are described below. Figure 4 presents a logic flow diagram showing the staging, interrelationships, and decision points for implementation. Two decision points are defined.

The first is reached after sufficient information is developed to select the treatment processes and candidate withdrawal wells and discharge locations. Costs estimates, secondary waste volumes, treated effluent quality, etc. can be established that would allow refinement to the direction at this time.

The second decision point allows the results of the treatment system operation to be evaluated and decisions made to continue, modify or terminate the operation. Operation would cease when sufficient information is collected to meet the goals of project.

Table 1

Major Tasks to Implement a Limited Pump and Treat System at N-Springs

1. Select candidate and backup wells for withdrawal of groundwater and disposal of treated effluent.
2. Conduct well useability testing to determine fitness for use of candidate wells.
3. Conduct field tests to determine the quantity of water, ^{90}Sr and tritium produced from each candidate well.
4. Evaluate and select candidate "off the shelf" treatment technologies.
5. Test, design and procure the treatment system.
6. Develop operating procedures.
7. Install and operate.
8. Evaluate and report on remediation system effectiveness.
9. Modify the system as appropriate to meet objectives.

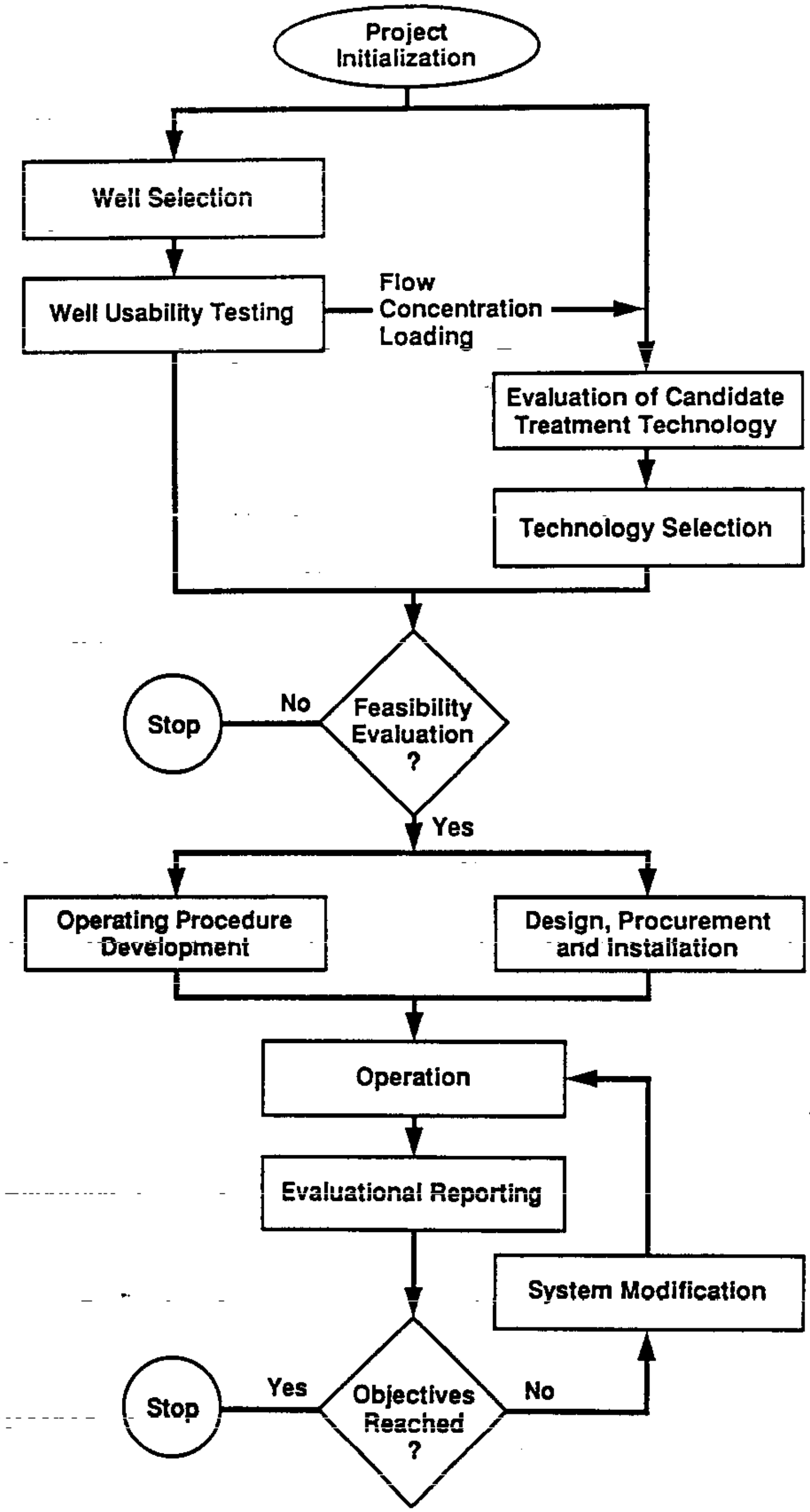

Figure 4. Implementaion of a Limited Pump and Treat System at N-Springs Logic Flow Diagram.

Task Descriptions

1. **Select candidate and backup wells for withdrawal of groundwater and disposal of treated effluent.**

Task 1 will evaluate the existing well network to select candidate wells for withdrawal and re-introduction of groundwater. Wells will be initially selected based on the following criteria

- o Construction details.
- o Nearness to the higher contaminated areas.
- o Expected ability to produce sufficient groundwater (10-20 gpm/well).
- o Relationship to the existing groundwater flow system
- o Sufficiently spaced apart to reduce "short circuiting" of water between the withdrawal and re-introduction locations, respectively.
- o Minimize impacts to the RCRA and Operational monitoring system.

Other criteria, as appropriate would be added during the selection process.

A significant problem in the design of pump and treat systems is usually defining the discharge location for the effluent from the treatment system. Even after treatment, effluent is expected to contain low levels of ^{90}Sr and tritium. Under this task it is also proposed to evaluate alternative disposal options including the potential for discharge to the river and for the use of any existing facilities. This evaluation would include such factors as the impacts of co-contaminants, the potential for mobilization of contamination, and costs.

A preliminary evaluation of the well system was conducted for this proposal. Table 2 shows the wells in the ^{90}Sr plume and some of their characteristics. Wells N-69 and N-80 are screened beneath the contaminated portion of the aquifer. Several other wells contain less than 5 ft of water, while the expected drawdown is up to 10 ft. Well N-14 historically has had high concentrations of ^{90}Sr, but is located on the edge of the plume. Well N-76 contains lower concentrations of ^{90}Sr, perhaps due to preferential flow paths. Initially, wells N-67, N-3, and N-75 appear to be the best candidates for useability testing. The locations of these wells in the ^{90}Sr plume are shown in Figure 3.

This initial evaluation did not determine potential wells for re-introduction on treated effluent to the ground.

Table 2. Wells in 1301-N ^{90}Sr Plume

Well	Construction	Screened Zone	Approx. ft water	^{90}Sr 11/93 (pCi/L)
199-N-2	8-in perforated casing	top of upper aquifer	18	130
199-N-3	8-in perforated casing	top of upper aquifer	20	837*
199-N-14	8-in perforated casing	top of upper aquifer	10	593
199-N-17	8-in perforated casing	top of upper aquifer	4	248*
199-N-54	6-in stainless steel screen	top of upper aquifer	3	290
199-N-56	6-in stainless steel screen	top of upper aquifer	4	N/A
199-N-67	6-in stainless steel screen	top of upper aquifer	4	2950
199-N-69	6-in stainless steel screen	bottom of upper aquifer	26	None detected
199-N-75	4-in stainless steel screen	top of upper aquifer	13	1000
199-N-76	4-in stainless steel screen	top of upper aquifer	15	59.1
199-N-80	4-in stainless steel screen	first confined aquifer	49	None detected*

* Data from 3/93

Representative range of transmissivity for the 100-N Area: 1000-6000 ft^2/d (Hydraulic conductivity approximately 25 - 150 ft/d) (Hartman and Lindsey, 1993)

Predicted drawdown at 20 gal/min for 4 hours = 10 ft (assuming a conservatively low hydraulic conductivity of 25 ft/d).

Best candidates are shaded: N-67, N-3, and N-75.
Note: N-75 was pumped for approximately 2 hours at 13 gal/min during development with approximately 4 ft of drawdown.

2. Conduct well useability testing to determine fitness for use of candidate wells.

For each well selected in Task 1, field testing would be conducted to determine the well's physical condition. Field testing would include a site visit, confirmation of depth and screen locations, camera survey, scrubbing and well re-development, as necessary.

3. Conduct field tests to determine the quantity of water, ^{90}Sr and tritium produced from each candidate well.

For those well that remain viable, additional field work would be initiated to determine an optimum contaminant production (or injection) rate for each well. Step drawdown tests will be conducted combined with sampling to estimate both the well's water production capability and the quantity of contamination that might be expected under extended pumping.

Each well will be pumped for an extended period (4 to 8 hours) to estimate concentration changes with time and flowrate. As needed, producing zones will be identified. This information will be used to establish the quantity and concentration of contaminants and other chemical species that impact the selection and size of the treatment system and the final configuration of the well network.

4. Treatment Technologies

There are three basic treatment technologies that can be tested singularly or in series to remove ^{90}Sr from groundwater. They are ion exchange, reverse osmosis, and biological treatment. Technology selection and related costs will initially depend on the well testing results and bench scale treatment test results.

5. Design, Procurement, and Installation

Technology design depend on the well testing results. The system design will allow feed splitting to test emerging technologies. Well location and technology selection will require a utility design. These design and procurement costs can be estimated when the technology to be tested is selected. A waste disposal system and related estimated costs will also have to be generated. Acceptance test parameters will be defined during the design phase prior to procurement.

6. Acceptance Test, Operating, and Waste Disposal Procedures

Acceptance test procedures will be written during the design phase. Operating procedures will be started during the procurement phase and completed during acceptance testing. The operating procedures will allow testing of emerging technologies. Waste disposal procedures will be developed during the installation phase.

7. Acceptance Testing and Operation

Operation will follow successful completion of the acceptance test. Operation philosophy will encourage automatic operation and versatility.

SCHEDULE AND COSTS

The proposed system is similar in size to systems under development for implementation in Operable Units UP-1 and ZP-1. Two major differences are noted: 1) at N-Springs high levels of surface and underground radiological contamination exist, and 2) groundwater is only 100 feet below the surface at N Springs.

Initial identification and selection of withdrawal and discharge locations should require limited personnel efforts and can be completed comparatively easily. However, process equipment identification, testing and procurement and design requires considerable lead time. Aside from personnel costs, the major cost will be operational costs. Such variables as availability of utilities, the extent of radiological control needed for the operation of the system (Nuclear Facility Classification?), the rate of waste generation and its disposal method, and the operational demands placed on the system will have significant impact on these costs.

Detailed costs are not available for this proposal. Based on treatability testing at UP-1 and ZP-1 Operable Units, order of magnitude estimated costs would be $ 1.5 million from initiation of the project to start-up, and $2.0 million/year in operating and waste disposal costs. Detailed costs and sheduled await a more thorough engineering review than was possible under the current deadlines.

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