

Draft Advice re: Proposed Plan for Remediation of the 100-NR-1 and 100-NR-2 Operable Units (DOE/RL-2012-68, Draft A)

Background

The 100-N area is the last of the 100 Area, River Corridor, RI/FS and Proposed Plans for submittal. The 100-N area consists of two Decision Units, NR-1, which is the source unit, and NR-2, the groundwater unit. There are 234 facilities, of which 76% have been demolished, and there are 175 waste sites and four RCRA TSD sites. Around 108 kilotons of contaminated soil have been removed.

The 100-N reactor, WNP-1 was the last of the production reactors. The N-area reactor was different in that it was a double loop design with a contained inner circulation that heat exchanged with cooling water from the river. Effluent from the inner cycle was discharged to trenches, which left deposits of strontium-90 and other contaminants which now act as sources for groundwater plumes. Levels of strontium in groundwater, the primary contaminant of concern at 100-NR-2, are as much as 1,000 times the regulatory standard. The highest concentration trench soils were removed to lower groundwater impact. An initial groundwater remediation attempt, employing a pump-and-treat system, was not effective and was costly. After more research and consultation with experts, the Tri-Parties conducted a test using a permeable reactive barrier (PRB) employing apatite to capture the strontium. The PRB proves to be quite effective at reducing dissolved strontium levels, and the PRB is being lengthened to the entire length of the strontium plume.

While the Board is heartened by the success of the apatite PRB, there remain a number of related concerns about the state of the 100-N operable units. While the PRB is effectively pulling strontium from the groundwater that passes through, there remains a highly contaminated plume between the PRB and the liquid waste disposal trenches. There is also an anomalous amount of strontium that resides in the foreshore gravels between the PRB and the Columbia River. There is a large nitrate plume that comingles with the strontium plume, which would be difficult to remediate using in-situ technology because that might clog some of the pore space in the PRB. Large spills of petroleum products have also created smaller plumes that demand remedial attention.

The Proposed Plan for remediation of the 100-NR-1 and 100-NR-2 Operable Units (DOE/RL-2012-68, Draft A) presents a number of alternatives that are being considered for the final remedy. Alternative 1 proposed no remedial action would be taken. Alternative 2 proposes the use of removal-treatment-and disposal of contaminated soils at Waste Sites, an apatite PRB for near-shore capture of strontium-90, a Technical Impracticability Waiver for the strontium-90

upland of the PRB, Bioventing for diesel residues (TPH-D) in the Vadose Zone, and MNA for TPH-D in Ground water, with groundwater monitoring, and Institutional controls to prevent exposure until cleanup levels are achieved. Alternative 3 is the same as Alternative 2, except that Biosparging is added to treat TPH-D in the groundwater. Alternative 4 contains all of the remediation steps as Alternative 3 but adding in-situ biological treatment of the nitrate plume. Alternative 5 adds apatite treatment of the upland strontium plume at a much higher cost.

Advice¹:

1. The Board advises that of the alternatives as they are described in Draft A of the Proposed Plan, the preferred Alternative 3 appears to best meet the objective of protective cleanup and reasonable cost.
2. However, the Board also advises DOE that not all alternatives have been evaluated in this Proposed Plan, the most obvious omission being an alternative with targeted R-T-D to reduce the strontium source at the more highly contaminated liquid disposal sites (basically three hot spots). This action thereby reduces the levels of strontium getting to groundwater at the source, and unlike the PRB, removes the contaminated material from the site. Another unevaluated alternative might employ mini-PRBs just downstream of the most highly contaminated strontium sources, to double the effectiveness of the apatite sequestration technique.
3. The Board supports Ecology's Feasibility Study comment (No.5) that phytotechnology (both phytoextraction and rhizofiltration) should be retained and evaluated to treat strontium-90 in order to form a full analysis of potential implementation. Ecology states that they expect to make a recommendation only after they have seen this evaluation. Ecology predicts that this move alone would shorten the remediation time (for groundwater flowing into the Columbia River) from a proposed 115 years to 50-75 years. The Proposed Plan provides a schedule that provides that DOE will continue work at 100-N for at least that long.
4. The Board noted that the Proposed Plan did not include remediation of the nitrate plume, while considering only the in-situ methods. The Board advises that nitrate exceeds drinking water standards and other nitrate remediation technologies exist, which include a number of ex-situ forms.
5. The Board advises DOE that employing a Technical Impracticability waiver for strontium-90 and opting not to remediate the nitrate plume dictates that greater than 100-year Institutional Controls will have to be maintained, groundwater levels monitored, adequate federal budgets allocated and public safety assured for a very long time. The

¹ **PLEASE NOTE:** *These advice bullets are numbered for ease of editing; they do not reflect order of importance and will be revised to a bulleted list following the editing process.*

Board advises the Tri-Parties that it has concerns that strontium-90 contamination is being left in place in the vadose zone and soil column. The Board is concerned whether the PRB will continue to function as well far into its 100-year plus life, and there may be environmental factors that could cause the strontium to be re-released to the Columbia River that haven't yet been evaluated.

6. The Board supports the addition of the vadose zone apatite injections to be installed above the groundwater apatite barrier. The Board is concerned with the design of the apatite barrier, and particularly with the fact that the barrier design depth does not intercept the entire flux of river-bound groundwater.
7. The Board advises DOE to recognize that while the permeable reactive barrier technology appears to capture strontium from the groundwater (in this case), the accumulation of radioactive material in the subsurface barrier represents the formation of a new potential source of groundwater contaminant, and that there has not been a lengthy enough test of this technology to assure that the remediation will remain durable into the foreseeable future. In addition, the site of accumulated strontium-90, if the barrier effectively captures strontium over time, will require protection from intrusion, like excavation and well drilling, and therefore will need strong Institutional Controls.
8. The Board finally advises that the area surrounding 100-N is culturally sensitive, and every effort must be taken to protect that trust.