THE NOCHAR® TECHNOLOGY DEPLOYMENT PROGRAM, PROVIDING A PROVEN METHOD WORLDWIDE FOR WASTE SOLIDIFICATION AND STABILIZATION

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ABSTRACT

With the recent fall of the Soviet government and the decommissioning of defense plants in the U.S. DOE Complex, and the increasing worldwide emphasis on environmental restoration and controls, a critical need has developed for a proven "off the shelf" technology to deal with these enormous hazardous waste issues. While many new technologies are on the horizon and under development to handle complex waste streams, few of these offer immediate solutions. High technology polymers are an answer to present day needs that will allow immediate burial site disposal, above ground depository use for "safe store" applications, and stabilization and immobilization plans for safe transport or incineration at a later date.

INTRODUCTION

Thousands of vacuum pumps and other equipment that supported DOE weapons development and production work over the past several decades produced reservoirs of waste oils that proved to be very difficult to dispose of. This critical need is intensified because many DOE facilities are now shut down and undergoing remediation, and organic waste disposal is on the "critical path" work schedule (4).

In August of 1999, the U.S. Department of Energy Miamisburg Environmental Management Project (DOE-MEMP) Office and BWXT of Ohio, Inc. (BWXTO) conducted an EM-50 demonstration utilizing PetroBond® polymer oil absorbent. The intent of the demonstration was to compare this innovative technology with the baseline options for disposal, which include incineration, long term storage for

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Fig. 1. Solidified Oil in a high density poly burial Liner- Top View

decay, and existing organic agents. There is a critical need at the DOE-MEMP for a simple and effective disposal method for organic waste, preferably something that will meet waste acceptance criteria (WAC) requirements for Nevada Test Site (NTS) (1), the Waste Isolation Pilot Plant (WIPP), and other licensed burial sites. This need is further exacerbated by the growing inventories of waste throughout the nuclear industry worldwide. The Mound Site, which it is commonly referred to, is a former DOE weapons production facility. These tests resulted in the successful stabilization and shipment of tritiated mixed waste oil with approval given by (NTS) as an authorized solidification product based on highly successful TLCP test results. (Table – I) (Figure - 2). Use of this solidification technology in a high density poly disposal container is illustrated in (Figure -1).

A few months after the conclusion of the demonstration, the Mound Waste Management Department received a letter of approval from NTS, waste profile Number AMDM-000000032, for "Solidified Oil Using Nochar PetroBond® Stabilization Agent" (5). Upon receipt of this approval, the Mound LSDDP concentrated on the final stage of its mission, that is, at the conclusion of a highly successful demonstration, taking measures to deploy this technology wherever useful throughout the DOE to solve complex problems and achieve cost savings.

NOCHAR TECHNOLOGY DESCRIPTION

The new innovative technology that was implemented is a high technology 3rd generation elastomeric polymer offered by Nochar® Corporation of Indianapolis, Indiana (2). From extensive experience in major commercial oil spill operations, Nochar® has designed a product for use in the nuclear environment that will absorb organics, solvents and other hydrocarbons with a mixture or "formula" of high tech polymers that can be designed to address the specific characteristics of a variety of waste liquids. It bonds the organic liquid into a soft, sponge rubber-like material.

Nochar is non-toxic, non-hazardous, non-corrosive and non-biodegradable (3). It produces no heat during the solidification process. It is incinerable to less than 0.02 % ash therefore allowing for possible final incineration at a later date. It has an absorbent capacity of up to 15:1 (ratio of oil to agent by weight) and up to 85:1 (ratio of water to agent using AcidBond®), with minimal volume increase. It has been tested to 40 MRad gamma exposure with limited evidence of radiological degradation, and as a single step process, requires no mixing.
Toxicity Characteristics Leaching Procedure (TCLP) analysis of NOCHAR® solidified oil shows effective results in almost every application to date.

Table I: Mound Solidified Mixed Waste Oil TCLP Analysis – Severn Trent Labs

Analyze	Physical Form	Result	Units	Reg Limit (mg/L)	Dilution	Method	SW-486
Mercury	Solid	.00092	mg/L	*0.2	4	TCLP Metals	EPA 7470
Arsenic	Solid	ND	mg/L	5	4	TCLP Metals	EPA 6010
Barium	Solid	ND	mg/L	100	4	TCLP Metals	EPA 6010
Cadmium	Solid	0.014	mg/L	1	4	TCLP Metals	EPA 6010
Chromium	Solid	0.0047	mg/L	5	4	TCLP Metals	EPA 6010
Copper	Solid	0.12	mg/L		4	TCLP Metals	EPA 6010
Lead	Solid	0.29	mg/L	5	4	TCLP Metals	EPA 6010
Selenium	Solid	ND	mg/L	1	4	TCLP Metals	EPA 6010
Silver	Solid	ND	mg/L	5	4	TCLP Metals	EPA 6010
Zinc	Solid	0.071	mg/L	NA	4	TCLP Metals	EPA 6010

Note: baseline values for untreated mixed waste oil were comparable to bench test I and II non-treated oil.
Worst case metals analysis was approximately 7.2 mg/L - Mercury.
***** Current Nevada Test Site (NTS) LDRs for Hg limit it to 0.025 mg/L.

THE NOCHAR® TECHNOLOGY DEPLOYMENT PROGRAM

Through sponsorship by U.S. DOE – Ohio, the Deactivation and Decommissioning Focus Area (DDFA), and the Transuranic Mixed-waste Focus Area (TMFA), Nochar PetroBond® has now been successfully deployed at sites in the U.S. and Canada through this technology "share" program**. A project team has been organized and involves the following team members when a deployment is initiated:**

- Deployment Project Engineer / Technical Expert
- Nochar Corporation Technical Consultant
- Host Site Project Management
- Host Site Technical Experts
- Deployment Project Manager / Coordinator

The program involves the following planned activities:

- Contact Waste Management and/or Project Management at each DOE Site to determine if the site has a need and desire to test Nochar® with a problem liquid organic or aqueous waste stream.
- Obtain a characterization profile of the sludge / solution to be treated at the site.
- Evaluate the waste stream to confirm applicability of the technology.
- Draft a brief project plan for each site to be reviewed by all cognizant representatives.
- Obtain representative samples of the waste in question from the site, for use in the deployment of Nochar® to that site, and prepare the site facilities for deployment.
- Train the site personnel in the use of the technology under the guidance of the technology representative, who will also assist the site in the first application of the technology in a bench test verification, and then in a drum/large container size demonstration, so that at least one large scale container of waste is successfully solidified.
- Examine and/or test the solidified sludge at each site, as required, in order to ensure that the (WAC) for the intended disposal facility will be met. In some cases a visual examination after solidification may suffice. In other cases, TCLP, total metals analysis, or other testing may be required by the site (6).
- Prepare a summary report to document the application and success of each EM-50 deployment of demonstrated technology at a site.

The Nochar Technology Deployment Program pays for its involvement with the host site, including providing the Nochar test product. The Host site pays for its own site costs and subsequent testing costs.

Deployment projects completed or in progress to date include: disposal of tritiated mixed waste oil at MEMP (est. 50,000 Ci inventory), solidification and transport of PCB / TRU oil at MEMP, solidification of (HB-40) organic coolant LLRW at Whiteshell Labs- Canada for safe store application, solidification of TRU oil at Rocky Flats for disposal at WIPP, motor oil treatment at Envirocare–Utah, stabilization of multi-phase vacuum pump oil at Sandia National Lab, solidification of radioactive contaminated Purex solution at Savannah River Site, solidification of a number of lubricants and water contaminated organics at Pacific Northwest Labs / Hanford, and Ashtabula Environmental Management Project (AEMP) where LLRW was stabilized and buried.

Sites where continued testing and/or study are taking place include: Savannah River Site, Princeton Plasma Physics Lab, Los Alamos National Lab, Sandia National Lab, Idaho National Engineering & Environmental Lab, Battelle Labs Columbus, Portsmouth DOE Site, and Chalk River Ontario.

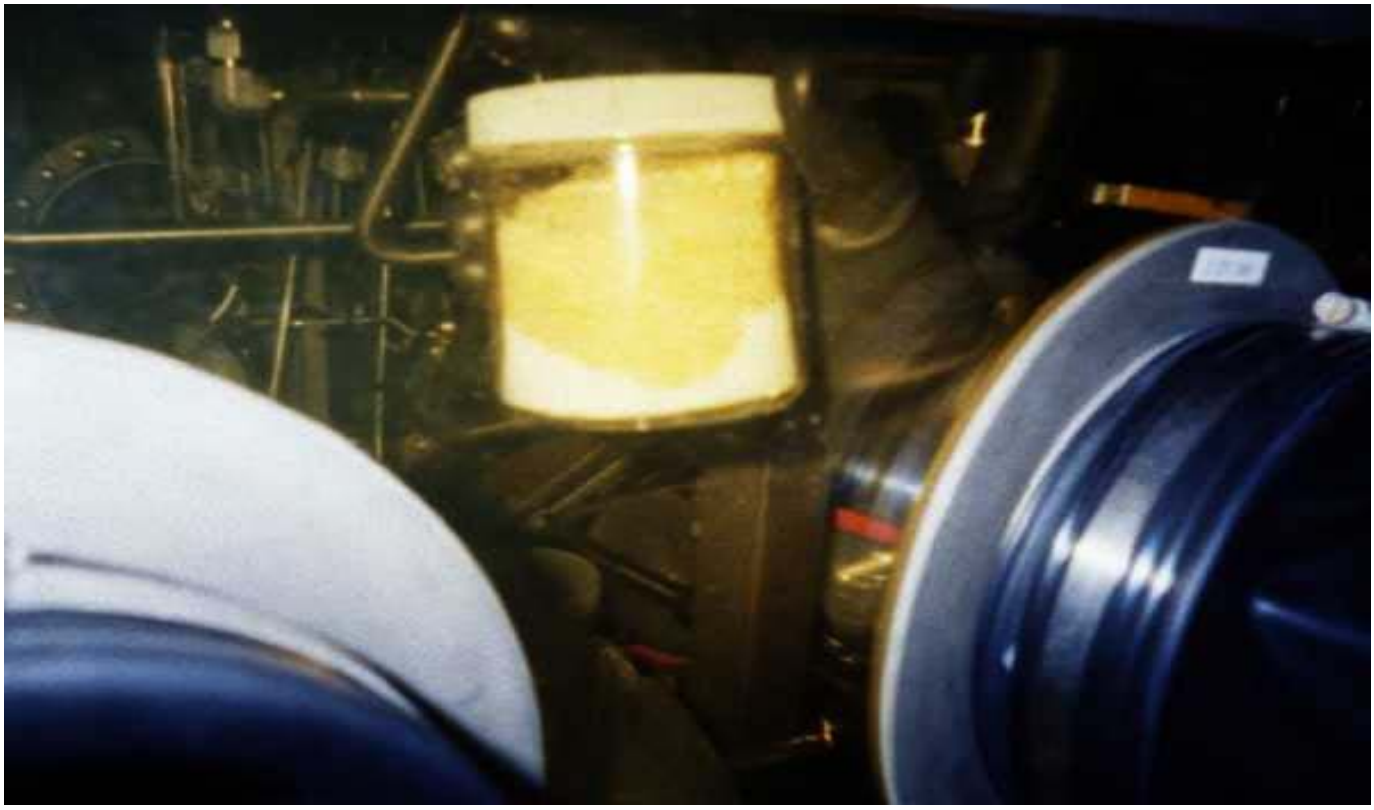

Fig. 2. High activity tritiated oil sample solidified inside a glovebox at Mound DOE Site.

INTERNATIONAL APPLICATIONS OF NOCHAR® TECHNOLOGY

Stored at the AECL Whiteshell Laboratory (WL) Waste Management Area (WMA), near Pinawa Manitoba, Canada, are ~12,000 liters of radioactively contaminated organic liquid resulting from operational activities conducted at WL. This material is a mixture of used WR-1 reactor coolant (HB-40), xylene rinse solution, dielectric (EDM) fluid, vacuum pump oil and water. The radioactivity of this liquid is above the allowable activity limit (15 Bq/ml) for incineration in the WL organic incinerator. Drums storing this material are showing evidence of leakage and swelling including the effects of long-term storage through repeated freeze thaw cycles that are brought on by the local climate. Demonstration solidification tests were conducted on bench-test samples of these liquids using Nochar PetroBond® with test results showing great success (Figure-3). Test Engineers were able to readily solidify samples of each waste stream and the resultant solidified product passed EPA method 9095 filter test for free liquid, as well as physical inspection of the solidified mass. This appears to be an efficient, safe, cost-effective way to treat the Whiteshell radioactive contaminated organic liquids. Planning is underway to solidify these wastes in stainless steel B-25 containers and to store the solidified waste form in existing above ground, low level bunkers at the WMA, under a "safe store" protocol at this time. This success as seen at Whiteshell has initiated interest and study that is continuing presently at the Chalk River Laboratory in Ontario.

Based on initial success now seen in the U.S. and Canada, Nochar Inc. has teamed up with a highly experienced International trading firm, Pacific World Trade Inc., that will help with worldwide introduction of this technology. Thus far, the following countries have hosted site visits or demonstrations and are considering PetroBond® for their organic and aqueous waste issues: Russia, Ukraine, Taiwan, Japan, Hungary, Bulgaria, Romania, Poland, Croatia, Latvia, Lithuania, Great Britain, Germany, France, Norway, South Korea, China, Slovenia, Czech Republic, Philippines, Indonesia, Mexico, and Brazil.

From this group, Slovenia has placed a significant product order and start work processing organic liquid waste. Romania, Slovenia, Russia and Ontario Hydro Canada are presently consulting with Nochar's International Group to solve their enormous waste issues involving solvents, scintillation fluids, and tritiated oils. Training will be conducted next year for international nuclear technicians at the Indianapolis Headquarters where Nochar has conducted advanced instruction in oil spill technology and fire protection chemicals for over a decade with their U.S. and worldwide client base.

Events that are going on today in the former Soviet Union present enormous challenges and opportunities for broad based applications of polymer technology. Decommissioning and massive clean up efforts are now centering around almost every facet of Soviet nuclear technology to include: Uranium mines, Defense weapons facilities and laboratories, Nuclear power plants (active and defunct), and Russian nuclear submarine fleets and associated facilities. Nochar PetroBond® technology can provide an immediate answer to stabilizing these dangerous and hazardous waste inventories for transport or disposal which Russia has now recognized through continued talks with the Nochar International Group. This communication is being promoted also through DOE cooperative programs that would encourage promising U.S. technologies such as PetroBond® be tested at Demonstration centers in Russia and the UK.

Fig. 3. HB-40 reactor coolant being solidified at Whiteshell Labs.

CONCLUSION

Data generated from the testing of this technology now shows great promise in providing solutions for complex waste handling issues within the U.S. DOE Complex, and at nuclear facilities throughout the world. With a worldwide initiative underway in below ground disposal, "safe store", and other waste remediation activities, Nochar PetroBond® polymers have set a precedence in providing immediate solutions to these critical needs.

REFERENCES

1. Nevada Test Site – Waste Acceptance Criteria (WAC).
2. Nochar® Inc., Indianapolis, Indiana – Product literature "Nochar PetroBond® Absorbent Polymer Oil Solidification Agent".
3. MSDSs, Nochar® PetroBond A660, A610, N990 polymers.
4. Published ITSR, "Nochar Solidification Technology", DOE/EM –0598.
5. U.S. Department of Energy, Nevada Operations Office, "Approval to Ship Mound Plant Low-Level Radioactive Waste to the Nevada Test Site", December - 1999.
6. Paint Filter Liquids Test, EPA Method 9095, 40 CFR 264.314 & 265.314.

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