

## New Program Focuses on Solutions for Cased Pipe

Utilities today are searching for technically viable and cost-effective solutions for the assessment of cased pipelines as required by pipeline-integrity regulations.

Many cased transmission segments located in High Consequence Areas (HCAs) are unable to be inspected with in-line devices, are located in difficult-to-access areas, or are not suitable for pressure testing. And while there has been an increase in the use of External Corrosion Direct Assessment (ECDA) methods, use of these techniques is limited for cased pipelines.

Recognizing the need for a concerted effort to address cased-pipe issues, two of the industry's leading research organizations—GTI and NYSEARCH—have formed the North American Casing Research (NACR) Program to review existing assessment options, perform a technology-gap analysis, and develop a plan for continued or future research. The program will also provide a framework to obtain



appropriate regulatory acceptance of new technologies and serve as a communications vehicle with regulatory bodies.

The new program is a collaborative effort, involving participation from natural gas distribution and transmission companies, research organizations, industry groups, manufacturers, and the regulatory community.

“Companies are finding it difficult to comply with pipeline-integrity regulations concerning the assessment of cased pipelines,” explains GTI Project Manager, Alicia Farag. “Through this new research program—and through subsequent research projects—we expect to provide operators with a suite of solutions that offer several approaches to achieve compliance.

“Currently, operators have few alternatives for compliance. However,

there are various research programs under way to help develop and define alternative methods of performing assessments of cased pipelines. One role of the NACR program is to review these and other developments from a ‘holistic’ perspective such that technology gaps and solutions can be quickly identified. Through the NACR, a structure is in place that helps to ensure that existing and future R&D efforts are working toward a common goal.”

**The objectives of the casing research program are to identify the scope of existing research; determine where additional efforts should be focused; coordinate supplemental research, development, and validation efforts; and to pursue regulatory acceptance of these new solutions.**

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## Cased Pipe Program

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Current research efforts applicable to cased pipe include Guided Wave Ultrasonic Inspection, development of tethered and un-tethered inspection tools, and various above-ground assessment techniques. Through the new cased-pipe program, members will identify technology gaps requiring further research. Projects will be individually proposed and appropriate sources of funding solicited from both within and outside the program membership.

**“We see the cased-pipe research program as a way to provide operators with a pathway to compliance,” says Farag.** “The plan is to engage all industry stakeholders and work cooperatively with the appropriate advocacy organizations, research organizations, and technical associations. This way, we can speak in one unified voice in the timely pursuit of regulatory acceptance of these emerging solutions.”

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## Cased-Pipe Research Areas

The North American Casing Research Program is designed to explore a variety of solution alternatives and has been divided into the following Focus Areas:

### Assessment

Improved assessment techniques and technologies can improve inspection abilities and reduce the cost of assessments.

### Risk Approach

The total number of casings that require baseline and follow-on assessments can be reduced through risk analyses that address the probability of failure and the consequences.

### Casing Removal

Casing removal can be a cost-effective method for compliance, allowing traditional assessment techniques to be used.

### Mitigation

Eliminating the need for inspections and/or assessments by reducing stress levels below 20% SMYS (while maintaining Maximum Allowable Operating Pressure) or removing external corrosion as a threat for filled casings may provide the most effective compliance technique.

### New Installations

Lifetime assessment costs can be significantly reduced when the need to assess cased pipe is incorporated into pipeline designs and construction.



## ENVIRONMENTAL INITIATIVE

# Carbon Management Information Center Formed

Early in 2008, GTI established the Carbon Management Information Center (CMIC) as a forum to address natural gas industry issues and opportunities in the evolving arena of carbon-emission controls.

“The public perception is often that natural gas is part of the carbon problem, not part of the solution,” notes GTI’s Neil Leslie, who helped develop the CMIC. “However, there are many opportunities for achieving least-cost carbon reductions with natural gas. In addition, in the area of gas operations, significant efforts are under way to improve the industry’s already excellent leak-management record. Through the

CMIC, an improved, coordinated effort focuses on developing information on environmentally-friendly technologies that impact the gas industry.”

The objectives of the CMIC are to:

- > Serve as a clearinghouse for relevant carbon-management information
- > Develop, where necessary, credible information products and functional tools
- > Help investors inform policy makers, public utility commissions, trade allies, and customers about the significant environmental, energy-efficiency, and cost-savings benefits of direct natural gas use.

**cmic**  
carbon management  
information center

Says Leslie: “A key role for the Center is to provide credible technical data in response to energy initiatives to develop improved regulations, codes, and standards.”

Additional plans for the program are to develop a comprehensive online information resource and conduct technology and market assessments.

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## UV Curing to Cut Time and Save Costs

**C**ured-in-place (CIP) lining—a cost-saving, less disruptive alternative to open-trenching replacement—is growing in popularity as an effective means for bringing new life to aging gas distribution lines. At GTI, research is under way to improve the lining process through the use of ultraviolet (UV) curing to decrease the customer outage time.

With typical CIP systems, flexible liners of woven fabric are impregnated with an adhesive, inverted into the host pipe, and pressurized to obtain a tight bond between the liner and the host pipe. The liner is then allowed to cure for 24 hours.

“CIP lining is gradually becoming a more common rehabilitation technique,” notes GTI Project Manager, Alicia Farag. “However, with increased use, **industry advisors have expressed a need to reduce the customer outage time by allowing lining jobs to be completed in one working day.**”

Under the sponsorship of Operations Technology Development, NFP (OTD), GTI partnered with Karl Weiss Company to investigate a variety of curing options and identified UV curing, which has also been used in other industries, as the technology with the greatest



A packing gland is used to allow the light train to pass through while maintaining pressure.

promise in providing cost-effective, reliable accelerated curing.

Unlike other forms of curing, UV curing is a chemical reaction and has no environmental impact or waste products.

### The Advantages

“UV curing offers several advantages,” Farag explains. “It provides a quicker cure and is not restricted by long pipe lengths. With UV curing, lining and curing can take place in one working day.”

Currently, jobs involving CIP liners usually take up to 24 hours to complete, due primarily to lengthy curing times. To address the issue, OTD-supported work is now being conducted to design, build, and test a UV curing system that reduces the curing time to allow a 1,000-foot pipe section to be cured in three hours. Specific activities include the development and testing of a new UV-light-sensitive resin and modification and testing of commercially available UV-curing light train systems.

In 2006, researchers developed a UV-sensitive resin that met the standard specifications for strength, chemical resistance, and other factors.

### Field Demonstrations

In 2007, field demonstrations were conducted with the new resin, a commercially available UV light train, and modified lining equipment to accommodate the light train. (The cleaning and lining procedures were the same as those used for the standard starline 2000® system.) Hosting the demonstrations were Public Service Electric and Gas Corp. (PSE&G) and Consolidated Edison Company of New York, Inc. (ConEdison). As with many GTI demonstrations, outside utilities, pipeline service contractors, and other interested parties were in attendance.

At PSE&G, the system was used on a low-pressure, 12-inch-diameter,



Commercially available light trains are used to accelerate the curing time.

cast-iron main 361 feet in length. The total lining time from first mix of adhesive until the final camera inspection of the UV-cured liner was approximately five hours. The UV curing process itself took slightly less than two hours.

“This demonstration brought us closer to commercialization by proving that the system will substantially reduce customer outage time,” says PSE&G’s George Ragula, Distribution Technology Manager.

At ConEdison, the demonstration was conducted on a low-pressure, 12-inch-diameter, cast-iron main 311 feet in length. Including a cleaning process and inspections, this project took about nine hours to complete. Curing time was 70 minutes.

Says ConEdison’s Tony Hranicka, Project Manager for Gas Operations Research and Development: “Through the demonstrations, we developed several ideas for further increasing the speed of the lining and curing process for future testing prior to market introduction.”

Additional demonstrations are scheduled for 2008 in efforts to increase the installation speed and decrease the diameter of the pipes to be lined and cured.

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## An Alternative to Steel Pipe in High-Pressure Applications

For several years, GTI has been investigating an advanced plastic gas piping material that has shown the ability to be safely operated at pressures currently requiring the use of steel pipe.

Now being field tested, the high-strength plastic—called Polyamide (PA12)—is a thermoplastic material that has demonstrated the ability to operate at pressures up to 250 psig based on the cumulative results of comprehensive testing and evaluation.

“The increased performance characteristics have made PA12 the preferred material in many demanding applications,” notes GTI Institute Engineer, Dennis Jarnecke. “The product is used as fuel lines in passenger cars and for air-brake tubing in trucks. However, we also see a great potential for its use in gas delivery systems.”

Currently, use of steel pipe is the only regulatory-accepted alternative for the distribution of natural gas at pressures above 125 psig. (PA12 and PA11—a product developed in an earlier program—currently require waivers for use above 100 psig.) With steel pipe, companies must use straight sticks of pipe, and adjacent sections must be welded and/or mechanically coupled.

“This not only adds to the cost of installation,” says Jarnecke, “but also creates potential leak sources.”

### The Benefits

Designed to operate at pressures up to 250 psig, PA12 can be safely used at higher pressures and temperatures than possible with current plastic materials (without sacrificing flow capacity) and provide the cost and installation advantages of plastic piping systems as an effective alternative to steel piping systems.

Today, plastic pipe is the material of choice for gas distribution, partly because steel systems require costly corrosion-control and monitoring measures. (The cost of corrosion



protection and maintenance for steel mains can be as high as \$700 per mile per year.) PA12 offers the benefits of plastic pipe while extending the range of operating pressures and temperatures. PA12 also provides an ability to bring gas to new markets that otherwise would be lost to competing energy sources due to the prohibitive costs of installing steel systems in some areas.

Presently, there are four commercial suppliers of PA12 worldwide. In the natural gas industry overseas, polyamide piping has been used to rehabilitate cast-iron lines and for low-pressure gas distribution. In recent years, GTI has been evaluating PA12 for use as gas-distribution piping in high-pressure applications in North America and is providing technical support necessary to obtain regulatory approval for its use in the United States.

### The Research Solution

With the support of Operations Technology Development, NFP, and PA12 resin suppliers (Evonik-Degussa AG, UBE Industries, and EMS), GTI conducted a regimen of extensive testing of PA12 materials, resulting in a comprehensive data base of the physical properties of PA12 pipe. Test data demonstrated that PA12 materials conform to all relevant requirements specific to PA12 contained within ASTM D2513. Evaluation of construction, maintenance, and operating considerations showed that conventional practices already in use for polyethylene materials could be readily

transferred to PA12 piping systems. It was also shown that there are no harmful effects of squeeze-off with respect to long-term performance considerations.

As part of the program, qualified PA12 joining procedures were also developed for pipe sizes up to six inches in diameter that are consistent with current practices.

The results of several “off-system” installations validated the use of PA12 piping systems at operating pressures up to 250 psig in combination with various types of in-service stresses that potentially act on the pipe once installed. Because the installation procedures for PA12 are similar to those of PE pipe, minimal crew training is required. It is estimated that the installed cost of PA12 pipe will be less than the installed cost for similarly sized steel pipe.

Investigators tested the key properties that govern the structural integrity of the pipe: the ability of the pipe to bear the stresses caused by gas pressure and ensure that gas is not lost through the pipe wall and its joints. Specific testing for structural integrity involved: 1) long-term hydrostatic testing, 2) tests to determine the pipe’s resistance to slow crack growth, and 3) rapid crack propagation testing. In addition to the completion of a variety of laboratory tests on PA12 materials, three small-scale field installations were performed using two-inch SDR11 and six-inch SDR11 pipe sizes operating at 250 psig in different types of backfill materials.

**GTI is currently soliciting potential utility candidates for installations to perform further field-demonstration evaluations with the support of the PA12 suppliers.**

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## New Device Locates Metallic Pipe Joints

**L**eak management is not just a matter of maintaining safety—it also helps to reduce emissions that can contribute to greenhouse gases.

Recognizing the benefits of taking a pro-active approach to leak management, in recent years Operations Technology Development, NFP, has been sponsoring the development of various technologies at GTI to help monitor, locate, and repair natural gas leaks.

One of the promising technologies currently being tested is the Metallic Joint Locator (MJL), a device that can locate joints in steel and cast-iron gas piping from the ground surface.

The new high-accuracy locator is designed to precisely detect joints—an important feature that allows the technology to be used in conjunction with the increasing use of small-hole excavation activities and assist in reducing the size of the hole during the joint repairs.

### Benefits

“Metallic joints are sometimes the starting points for natural gas leakage in gas distribution pipelines,” explains GTI Institute Engineer, Kiran Kothari. “By being able to easily locate these joints, utilities can avoid having to conduct expensive and often unnecessary excavations.”

The simplest excavation in an urban environment can cost \$1,000, and a large excavation can commonly cost \$5,000. With a modest expected selling price for the MJL, even a small number of avoided excavations will provide a rapid payback. Given that there are roughly 400 joints per mile of cast-iron main, use of the tool can provide significant benefits for gas operations.

In addition to cast-iron joints, the MJL may be able to also find chill rings in welded steel pipe, metallic tapping tees, metallic flanges, and metal repair clamps.



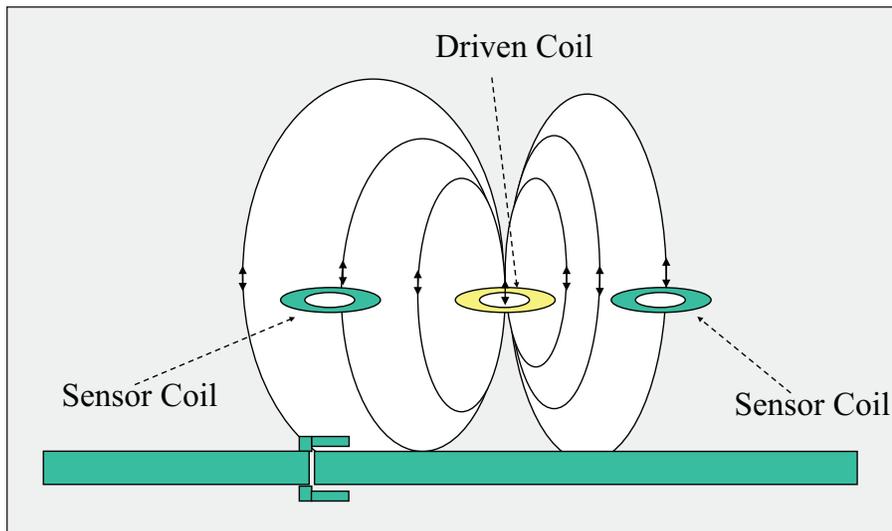
### The Concept

The MJL uses a drive coil to induce magnetic flux into the buried pipe from above ground and without requiring contact with the pipe. Tuned sensing coils are symmetrically located on either side of the drive coil. The signal difference in the sensing coils indicates the additional metal present in a joint or mechanical fitting. A laboratory prototype was able to detect cast-iron joints up to a depth of one meter. The device is wheeled across the ground along the length of pipe. Readings are automatically triggered by an odometer wheel, stored internally, and retrieved via serial link.

In 2007, the MJL was field tested in Illinois with Nicor Gas and in New York with National Grid and Consolidated Edison Company of New York, Inc. Through these tests, researchers identified several ways to modify and enhance the product.

OTD and GTI are presently seeking to identify interested manufacturers to commercialize this technology.

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The Metallic Joint Locator is towed across the pipe location. The extra metal in the joints creates a change in the magnetic balance that is detected by the instrument's sensors.

## Lift-Assist Device Eases Task of Pavement Breaking

A new system for use with jackhammers has been developed to enhance the ability of construction crews to maintain a high productivity level, help reduce the risk of injury, and help contain operational costs.

Now available from Integrated Tool Solutions (ITS) as the JA90-350 Jackhammer Lift Assist, the device is used to automatically lift heavy pavement breakers for repositioning.

The Lift Assist—which can be attached to commonly used jackhammers—incorporates a pneumatic piston that pushes the jackhammer

up and out of the pavement with little effort on the part of the operator.

The system was developed through GTI under the sponsorship of Operations Technology Development, NFP. Prior to its market introduction, in 2007 five field demonstrations were performed at utilities across the country to test the operation of the device.

“The tool has been well received by the industry,” says Andy Hammerschmidt, who managed the project at GTI. “It reduces physical stress, is simple to operate, and increases worker productivity. It’s a very promising step forward in bringing ergonomically-friendly technology to an industry faced with an aging workforce.”

New York State Electric & Gas Corporation (NYSEG), in conjunction with Rochester Gas and Electric Corporation (RG&E), hosted an initial demonstration of the technology.

“We received very positive feedback from our operators,” notes Allen Peterson, R&D Coordinator, NYSEG and RG&E. “We purchased



additional units and will continue to evaluate the technology and incorporate it into field operations.”

Southern California Gas Company (SoCal) was the first company to purchase the new device, putting the lift assist to the test on 90-pound jackhammers.

“The response has been good,” reports Gilbert Ching, Technical Advisor of SoCal. “In fact, we purchased three more units to expand our evaluations throughout our company because the existing crews will not give them up.”

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## New Projects Designed to Advance Operations

Maintaining the deliverability and efficiency of natural gas storage operations is a primary concern of gas companies committed to providing reliable supplies.

At GTI, this concern is being addressed through a variety of research and development efforts. New efforts include the development of a hydrate-mitigation system and research into enhancing well bore integrity management.

### Hydrate Mitigation System

The effectiveness of underground gas storage operations is often

hampered by the formation of hydrates in well bores and gathering systems. In response, under the sponsorship of Operations Technology Development, NFP, GTI researchers are developing a hydrate-mitigation system to help predict hydrate formation, better manage mitigation activities, and provide a cost-effective flow-assurance program.

“Gas hydrates are molecules of methane locked in a cage of water molecules,” explains GTI Program Manager, Andy Hammerschmidt.

“Under certain pressure and temperature conditions, the hydrates can form a ‘slush’ or solid mass in pipelines, wellheads, valves, or other fittings. This can restrict or even completely stop the flow of gas.”

GTI researchers are developing an integrated approach to provide a hydrate-formation early-warning system and mitigation plan.

Research is focused on developing a predictive hydrate-formation database with a software interface. The dynamic system will gather system piping information to allow

it to be customized to any storage operator's delivery system.

Benefits include up to 75% potential reduction in methanol use and its associated costs.

### Improving Well Bore Integrity Management

Scaling, corrosion, precipitates, and casing defects are all issues storage operators face on a continual basis in managing the integrity of their gas storage assets. These issues often lead to diminished deliverability (5% to 20%), as well as casing-integrity issues requiring costly remediation.

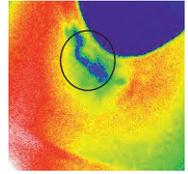
The mineral scale formation and material defect assessment process in well bores is complicated, time consuming, and costly. However, with the support of GTI's Sustaining Membership Program, the Gas Storage Technology Consortium, and the Pipeline Research Council International (PRCI), GTI is focusing on the feasibility, development, and

demonstration of a real-time reverse geometry digital (RGD) X-Ray tool for in-situ compositional identification of scale to help address mineral scale formation. The technology will also quantify material defects, pittings, and penetrations in casings and tubes.

"This technology is currently being used to assess integrity of Space Shuttle material within the NASA program," says Hammerschmidt. "The goals in our program are to use the technology to improve well-bore integrity assessment, flow deliver-

ability, and reduce operations and maintenance costs."

RGD X-Ray technology involves the use of an array of crystal detectors to simultaneously acquire RGD X-Ray images from several different positions.



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### Gas Hydrates Resource Characterization Laboratory

Gas-storage-related research at GTI is often conducted at GTI's Gas Hydrates Resource Characterization Laboratory, a state-of-the-art center that includes a reaction cell, into which an actual or simulated hydrate core sample can be placed for ultrasonic analysis. The cell houses an array of six compressional-wave and six shear-wave source and receiver pairs. A computer controls temperature and pressure in ranges from 63.7 to +170 degrees C, and 0 to 5,076 psi, respectively. The unit also incorporates pressure and temperature transducers, and volume and rate measurement devices.



## MARKET-READY SOLUTIONS

### Technologies Available for Licensing

The following is a description of several technologies pertaining to gas operations that are available to be licensed to manufacturers for launch to the market. For a listing of additional technologies, please visit [www.gastechnology.org](http://www.gastechnology.org), click on "Commercial Opportunities," and then on "Distribution and Pipeline Technology."

#### Metallic Joint Locator

This patent-pending technology has been field demonstrated to successfully locate various joints in metal pipes (bell joints, encapsulated joints, clamps, tees, couplings, etc.) from above ground at depths ranging to more than four feet.

#### Automated Meter Shut Off

This patented technology allows remote shut off of natural gas

service at meter sets. The intended configuration could be installed in several minutes without interrupting gas service. The device provides a means to limit collection losses from frequently delinquent accounts.

#### Leak Pinpointer

This patented technology has been field demonstrated to pinpoint the location of leaks accurately. It is intended to precisely locate leaks of natural gas, steam, water, and high-voltage electrical line oil. For the pinpointing of natural gas leaks, the technology does not suffer from inaccuracies resulting from wet ground, gas saturation over a large area, gas migration away from leak site, and multiple leaks in close proximity that can hinder currently available technology.

#### Keyhole Tracer Wire Connector

This patented technology allows joining of two wires, such as a tracer wire marking a service line to one marking a main, from within keyhole excavations. Traditional wire nut-type connectors that are twisted on by hand aren't suitable for installation via keyhole excavations because of the limited access. This technology can also be applied to the joining of wires in traditional excavations, meaning utilities could inventory a single connector to meet all excavation needs. Several utilities have already installed these connectors on a limited-use basis.

For more information, contact: Quinton Ford, GTI Director, Commercialization, (847-768-0646; [quinton.ford@gastechnology.org](mailto:quinton.ford@gastechnology.org)). ▼ ▲

# Certification Program for New Field Technicians

**G**TI recently established a new Certified Operations Technician (COT) training program designed for entry-level gas-company employees and operations staff progressing in skill-specific field positions.

The overall COT program consists of one core course and additional elective courses that feature specific skills in gas transmission and distribution. The program is modular and training can be targeted to focus on

advanced courses and skills for more experienced employees.

The COT program takes a trainee through a series of basic and advanced skill sets designed to enhance on-the-job performance and quickly bring the trainee to the level of a full-functioning, skilled employee.

The core course—*Natural Gas Operations: Basic Field Training*—consists of 70 hours of instruction. It covers an introduction to natural gas, natural gas properties, the structure of the industry, and a detailed examination of construction, operations, measurement, gas quality, gas control, safety, and other practices.

Trainees can then choose four or more elective courses—

depending on the desired skill path and depth of training—from modules in 10 gas transmission and nine gas distribution topical areas. Through the elective courses, the trainee progresses from conceptual principles into advanced areas of each topic. The task specific elective courses also serve as a complimentary training tool to existing operator qualification (OQ) programs. In

addition to COT certification, trainees receive, for

each elective course completed, a certificate that lists the applicable OQ tasks by name and description.

For a list of topics covered in the core course and elective course options, contact:

Flo Kellogg, GTI Manager, Distribution, Transmission,

and Marketing Training

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## Upcoming Courses and Conferences—2008

Month	Dates	Program	Location
June	9–11	ECDA Inspection Tools	Chicago
	16–18	Polyethylene (PE) Piping 101	Chicago
	16–20	Factors in Compressor Station Design	Chicago
July (week 1)	14–18	Gas Distribution Engineering: Piping and System Planning	Chicago
	(week 2) 21–25		
August	11–15	Measurement and Regulator Station Design for Distribution Systems	Chicago
	11–15	Gas Transmission Operations	Chicago
September	15–19	Transmission Pipeline Design and Construction Practices	Chicago
	22–26	Measurement and Regulator Station Design for Transmission Systems	Chicago
November	10–14	Fundamentals of Baseload LNG: Markets, Technology, Economics	Houston

In addition to courses and conferences, GTI also provides educational opportunities in onsite, online, and custom-training formats.

For more information, go to the Training & Conferences area of the GTI website.

## Need More Information?

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